

## Appendix R

### Sample Scopes of Work

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**PART 1- GENERAL****1.1. GENERAL**

- A. Provide and install all equipment, materials and designated systems in accordance with this Specification.
- B. National Park Service Regional Structural Fire Management Officer (RSFMO) is the AHJ for this project.

**1.2. SCOPE**

- A. Provide a new analog addressable fire alarm system as required by the contract, applicable codes, and other project requirements. Repair all damage caused by the installation of this project, by patching and painting as required by Annex A. The system shall provide detection in all areas, be complete in all respects, tested, fully operational, and ready for operation at project completion.
- B. Furnish all labor, supervision, tools, materials, equipment, transportation, and management necessary to perform design and construction services for the installation, alteration, repair, replacement, upgrade, calibration, programming, inspection, testing, and other related services for the fire protection systems specified herein.
- C. Work performed pursuant to these specifications by the Contractor shall be complete in every respect, resulting in a system installed in accordance with these specifications, referenced codes, standards, manufacturer's recommendations and Underwriters Laboratories, Inc. (ULI) listings, or FM Global approval.
- D. No deviations from these specifications shall be made without written authorization from the RSFMO.
- E. Exercise "good housekeeping" during the installation, and minimize stockpiling materials in high visibility areas.
- F. All project related work with Historic buildings or NPS museum collections must be in compliance with all National Park Service requirements. Special measures shall be taken to minimize impact of damage to historic fabric, dust and debris control, and any related site damage.
- G. Upon completion of the project, provide complete system documentation and end user training to appointed Park Service personnel.

**1.3. SUMMARY**

- A. This Section specifies a fire alarm system, including requirements for system components typical of those below:
  - 1. Alarm Initiating devices (smoke & heat detectors, waterflow switches, manual fire alarm boxes, etc.) to provide detection in all areas of the building(s).
  - 2. Notification appliances.
  - 3. Fire alarm control unit (FACU).
  - 4. Control and monitor relays or modules.
  - 5. Supervisory initiating devices (valve supervisory devices, water level devices, fire pump supervisory devices, etc.).
  - 6. Remote annunciators with system controls.

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- B. Where this specification refers to the “system”, the complete fire alarm system, including all systems and field devices shall be implied.

#### 1.4. CODE REQUIREMENTS

- A. Work included herein shall comply with applicable portions of the codes and standards below, unless otherwise specified by the RSFMO. The following publications or applicable portions thereof are requirements of this Section: **The specification writer shall update applicable codes and delete referenced codes as appropriate to the installation.**

1. ANSI A17.1, *Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks*, \_\_\_\_\_ edition.
2. IBC, *The International Building Code*, \_\_\_\_\_ edition.
3. NFPA 13, *Installation of Sprinkler Systems*, \_\_\_\_\_ edition.
4. NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, \_\_\_\_\_ edition.
5. NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, \_\_\_\_\_ edition.
6. NFPA 70, *The National Electrical Code*, \_\_\_\_\_ edition.
7. NFPA 72, *National Fire Alarm Code*, \_\_\_\_\_2013\_\_\_\_\_ edition.
8. NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems*, \_\_\_\_\_ edition.
9. NFPA 101, *Life Safety Code*, \_\_\_\_\_2012\_\_\_\_\_ edition, as amended by NPS RM 58
10. NFPA 170, *Standard for Fire Safety Symbols*, \_\_\_\_\_ edition.
11. UL 1971, *Standard for Safety Signaling Devices for the Hearing Impaired*, \_\_\_\_\_ edition.
12. UL 38, *Standard for Safety Manually Actuated Signaling Boxes for Use with Fire Protection Signaling Systems*, \_\_\_\_\_ edition.
13. UL 268, *Standard for Safety Standard for Smoke Detectors for Fire Protective Signaling Systems*, \_\_\_\_\_ edition.
14. UL 268A, *Standard for Safety Standard for Smoke Detectors for Duct Application*, \_\_\_\_\_ edition.
15. UL 521, *Standard for Safety Heat Detectors for Fire Protection Signaling Systems*, \_\_\_\_\_ edition.
16. UL 864, *Standard for Safety Standard for Control Units for Fire Protective Signaling Systems*, \_\_\_\_\_ edition.
17. National Institute for Certification in Engineering Technologies, Division of NSPE.

- B. Conflicts: Where the applicable codes and standards differ, the more stringent requirement shall be applied. Where Codes and specifications conflict, the specification shall apply.
- C. Some requirements of this specification are in excess of those stated in the applicable codes and standards. These additional requirements are intentional, and shall be adhered to.
- D. Where items from the referenced Codes and Standards are repeated in this section, it is intended to call attention to them. It is not intended that other parts of the referenced Codes and Standards shall be assumed to be omitted if not repeated in this section.

#### 1.5. DEFINITIONS

- A. Reference: *NFPA 72, National Fire Alarm Code*, Chapter 3 – Definitions shall apply.
- B. Addressable Initiating Device: One that can be specifically identified by the control unit, although there may be other initiating devices on the same circuit.
- C. AHJ – Authority Having Jurisdiction. For all National Park Service projects, the Regional AHJ for fire protection is the Regional Structure Fire Management Officer (RSFMO).

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- D. Analog Initiating Device: One that can indicate the level of the state being reported, such as the temperature, not just that a specific temperature has been reached. On this project they will be smoke detectors.
- E. Applicable Sections: Portions of referenced codes and standards that contain requirements relating to equipment, systems or functions described herein.
- F. COTR – Contracting Officer Technical Representative. An NPS employee designated as the Contracting Officer representative. All contracting questions or proposals must be reviewed by this individual.
- G. Delegate – An appointed official by the RSFMO, representing the RSFMO.
- H. Equipment: Active functioning items such as controls, initiating devices and notification appliances. Equipment includes cabinets and large enclosures.
- I. Furnish: Deliver to the Owner's Representative for his use, or to the job site for installation.
- J. Install: Furnish, mount, connect and test for operation
- K. Main FACU, Addressable fire alarm system controls that serve as the primary fire alarm control unit in the building. Responsible for protecting primary building, monitoring all Out-Building FACU(s), and communicating selected zone information with Out-Building FACU(s).
- L. Materials: Inactive items such as wire, conduit and fittings.
- M. NPS – National Park Service
- N. Notification Appliance: A device that indicates a change of state. Notification appliances can have audible or visible outputs. They can also have other sensory outputs such as vibration, textual, and graphical. Strobe lights, annunciators, and sounding devices such as speakers and bells can be notification appliances.
- O. Provide: Perform the services or functions described
- P. Record Drawings: Formerly called "As-Built Drawings.
- Q. RSFMO – NPS Regional Structure Fire Management Officer is the delegated Authority Having Jurisdiction (AHJ) for fire protection.
- R. Remote: FACU A remote fire alarm control unit connected to the Main FACU to allow expansion and distribution of notification, initiation, or signaling line circuits throughout a building.
- S. RM-58 – Reference Manual for the National Park Service Structural Fire Protection requirements. The RM-58 is available through the NPS project representative and provides requirements for fire protection in NPS facilities.
- T. Shop Drawings: Sufficient drawings (including cross sections), equipment layouts, calculations, and manufacturer's descriptive and technical literature to enable the owner and code authorities to evaluate the proposed design and installation.
- U. Signaling Line Circuit: A circuit on which addressable devices are connected, or on which signals are transmitted and received.
- V. Out-Building FACU: A fire alarm system, connected to the Main FACU, that protects another building.
- W. Wiring Style and Class: See reference *NFPA 72, National Fire Alarm Code*, Tables 6.5, 6.6.1, and

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6.7.

- X. Zone: A defined area in which notification appliances sound. Each building will be considered a zone. The outside areas covered by external notification appliances will also be considered a zone.

\*\*Unless otherwise defined above, the definitions of terms in NFPA 72 shall apply when those terms are used in this Specification.

1.6. SYSTEM DESCRIPTION

- A. General: Provide a complete operational analog addressable fire alarm system with initiating devices, notification appliances, and control functions.

- B. Design: Design of the new system shall be as follows:

1. Main FACU: Shall be located in an accessible area, as approved by the RSFMO or Delegate.
2. Remote FACU and NAC Booster Panels: Shall be located in, accessible electrical rooms throughout to evenly distribute signaling and notification circuits.

NOTE: It may be desirable, in some applications, to use Remote FACPs in place of NAC Booster Panels. Discuss with RSFMO staff before designing the system.

3. Out-Building FACU: Shall be located in separate buildings if NFPA 101, (*Life Safety Code*), RM-58 or RSFMO requires a fire alarm systems in those buildings.
4. Remote Command Console: Shall be required if main FACU is greater than 457 mm (18 in) by 533 mm (21 in). The Remote Command Console shall be located in an area acceptable to the RSFMO. Additional remote Command Console shall be located at the main interior entrance wall in the building it serves, and acceptable to the RSFMO.
5. Detection: Provide as required by NFPA 101 (current edition), Life Safety Code, as amended by the NPS Addendum as follows.

NOTE: Expand on types and location here, as required by NFPA 101-2012, as amended by the NPS.

- a. Area smoke detectors located **Insert locations here.**
- b. Heat detectors located **Insert locations here.**
- c. Duct smoke detectors located **Insert locations here.**
- d. Sounder base smoke detectors located **Insert locations here.**
6. Manual fire alarm boxes: Install on the latch side of each exit door on every floor and elsewhere so travel distances between manual fire alarm boxes do not exceed 61 m (200 ft).
7. Alarm Notification:
  - a. Silenceable audible notification appliances shall be installed throughout the facility

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to maintain Sound Pressure Levels (SPL) at 15 dBA above ambient sound levels throughout, but not to exceed 110 dBA anywhere. Audible notification appliances shall not be installed in restrooms. Notification appliances shall comply with applicable sections of NFPA 72.

- b. Silenceable visible notification appliances (strobes) shall be installed in all corridors, halls, open office areas, conference/meeting rooms, restrooms, and public waiting areas in accordance with *NFPA 72, National Fire Alarm Code*.
  - c. All visible notification appliances shall be synchronized throughout each area where more than two (2) appliances are visible.
8. System Printers: A system printer shall be installed at the Main FACU. Power for this printer shall be by a monitored power supply from the Main FACU. **(Discuss with Regional Structure Fire Management Officer prior to submitting plans and selecting a system)**

**NOTE:** An integral printer or dot matrix printer will be selected by the RSFMO, based on the conditions at the . Contact the RSFMO before submitting designs.

9. Elevator Recall: Phase I (primary) and Phase II (firefighter's operation) elevator recall shall be installed as required by ANSI A17.1. A minimum of three (3) control modules or relays shall be provided at each elevator controller for Phase I and Phase II operation. Control modules shall be installed not more than 1 m (3 ft) from the elevator controller it serves.
10. Elevator Shutdown: Where shafts and/or machine rooms are sprinklered, elevator power (shunt trip) shutdown shall be provided by heat detectors adjacent to sprinkler heads in hoistway and machine room. Heat detectors used for this feature shall be system-type heat detectors connected to the fire alarm system and actuation of shunt trip shall be accomplished by use of a control module or relay. Control modules shall be installed not more than 1 m (3 ft) from the shunt trip devices they serve.
11. Elevator Power Shunt Supervision: Provide where elevator power shunt trip features are used and shall result in an identified supervisory signal at the FACU.
12. Fire Pump Monitoring:
- a. Electric – Provide supervisory signals for phase reversal, loss of power, motor run, low pump room temperature.
  - b. Diesel – Provide supervisory signals for switch "off", motor running, engine trouble, low pump room temperature.
  - c. Water Temperature Monitoring: Provide a temperature supervisory device for a fire protection water storage container exposed to freezing conditions. It shall initiate two separate and distinctive signals. One signal shall indicate a decrease in water temperature to 4.4 °C (40°F) and the other shall indicate its restoration to above 4.4 °C (40°F).

**NOTE:** Room and water temperature monitoring is necessary in climates subject to freezing. Revise text as necessary, based on location.

13. Water Level Monitoring: Provide high and low water level monitoring in fire protection water supply tank.

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14. Water Flow Switches: Provide fire sprinkler water flow switches supervision. Retard shall initially be set for 60 seconds. Additional delays caused by system software shall not be permitted.
15. Valve Supervision: Provide fire sprinkler and fire pump valve supervision. Supervisory signals shall be indicated within 2 full turns of the handwheel or 1/5 of the travel distance of the valve.

1.7. SUBMITTALS

- A. Schedule: Submit, to the RSFMO within 7 calendar days of notice to proceed, the proposed work schedule. This schedule shall indicate, as a minimum, the time necessary for:
  1. Project start-up.
  2. Report and Design Recommendations. Provide alternative recommendations (if applicable) that would benefit the Park. Submit all documentation identified in NFPA 72 section 7.2, 7.3, 7.4, and 7.5 (7.5 documentation upon completion). The narrative identified in 7.2.1 (1) shall include occupancy type, construction, and estimated occupant load from NFPA 101.
  3. Shop drawing submittals including cross sections.
  4. Demolition plans.
  5. Installation, identifying specific areas or floors. Installation shall include demolition, wiring, devices, patching and painting.
  6. Pre-testing.
  7. Final acceptance tests.
- B. Shop Drawings: Submit, to the RSFMO within 30 calendar days of notice to proceed, shop drawings in both electronic and hard copy (paper) format containing the following information:
  1. Location and type of all equipment and devices on floor plans.
  2. A riser diagram, showing the actual types and quantities of devices on each circuit.
  3. Symbols conforming to NFPA 170.
  4. A legend for all symbols used.
  5. Scale used, North indication, and match lines (if applicable).
  6. Site plan, where the premises include multiple buildings.
  7. Conductor and conduit identity, end of line devices, risers, conduit, junction, and pull boxes.
  8. A schedule showing the number, type, and size of all conductors and conduit planned.
  9. Device address or zone and device number for each device.
  10. Identification labels, numbers, and references for all conductors.
  11. Identification labels, numbers, and references for all junction/splice boxes.
  12. Typical details of all terminations in floor terminal boxes, field devices, and panels.

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13. Typical details for mounting of all device types, terminal and junction boxes, and equipment incorporated into the design.
14. Location(s) of all penetrations through fire rated barriers.
15. Matrix of operation in graphical form. Matrix to show all alarm and supervisory input devices on the left side and all possible indications of the fire alarm system across the top, including bypass functions.
16. Drawings shall not be smaller than ISO A1 sheets 600 mm (24 in) by 900 mm (36 in) in size. Scale shall be no smaller than 1/8".
17. Revision number and date.
18. Name of organization and the system designer; and any applicable stamps or seals.

C. Product Submittals (Cut Sheets):

1. Submit with the bid a detailed equipment list, identifying specific types, models and quantities of all materials, devices and equipment proposed. This submittal shall include manufacturers' data sheets showing the specific types and models of all equipment, appliances, devices, materials (including fire stopping), and conductors and cable proposed. Evidence of ULI listings and local approvals, if required, shall be submitted with the data sheets.
2. The proposed product shall be clearly indicated by arrows or other suitable means when a data sheet shows more than one product.

D. Record (As-Built) Drawings: Submitted to the RSFMO within 30 calendar days of acceptance and shall contain the following information:

1. Actual location and type of all equipment and devices on floor plans, including the actual matrix of operation.
2. A riser diagram, showing the actual types and quantities of devices on each circuit.
3. Symbols conforming to NFPA 170.
4. A legend for all symbols used.
5. Scale used, North indication, and match lines (if applicable).
6. Site plan, where the premises include multiple buildings.
7. Conductor and conduit identity, end of line devices, risers, conduit, junction, and pull boxes.
8. A schedule showing the number, type, and size of all conductors and conduit used.
9. Device address or zone and device number for each device.
10. Identification labels, numbers, and references for all conductors.
11. Identification labels, numbers, and references for all junction/splice boxes.



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12. Details of all terminations in floor terminal boxes, field devices, and panels as installed.
  13. Actual conduit routing as installed.
  14. Location and connection of AC power disconnecting means.
  15. Matrix of operation in graphical form. Matrix to show all alarm and supervisory input devices on the left side and all possible indications of the fire alarm system across the top, including bypass functions.
  16. Drawings shall not be smaller than ISO A1 sheets 600 mm (24 in) by 900 mm (36 in) in size and minimum 1/8" scale.
  17. Revision number and date.
  18. Name and organization of the system designer and any applicable stamps or seals.
- E. Operation and Maintenance (O&M) Manuals: Submit No fewer than 3 copies to the RSFMO during acceptance testing the following information:
1. Reduced 280 mm (11 in) by 432 mm (17 in) as-built drawings, including the required matrix of operation.
  2. Manufacturers' data sheets for all installed equipment, wire, and fire sealant products.
  3. Manufacturer's recommended testing & maintenance schedule and procedures.
  4. Complete operating instructions.
  5. Repair and trouble shooting guide, which lists common causes for breakdowns, malfunctions, and recommended repairs.
  6. List of spare parts provided under this contract.
  7. Battery calculations and voltage drop calculations.
  8. Record of Completion as required by *NFPA 72, National Fire Alarm Code*.
  9. Completed record of Inspection and Test as required by *NFPA 72, National Fire Alarm Code*.
  10. Written certification that the fire alarm system complies with Contract Documents and applicable codes.
  11. Two (2) electronic copies of (bound) files on CD in AutoCAD 2002 (or earlier editions). All CAD files shall be audited and purged. Where a specific desktop version (e.g., architectural desktop) is used, the version shall be identified in writing to the RSFMO.
  12. Laminated operating instructions for mounting at the FACP.
  13. List of replacement parts (with prices) and supplier where they can be purchased for a minimum of 36 months.
- F. System Software: Submit two (2) copies of all system software to the RSFMO within 30 calendar days of acceptance and shall be provided on electronic medium.

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1. Provide a complete copy of system software and program files sufficient to perform all programming and operational functions associated with the system.
  2. Provide all passwords and access codes to modify system.
- G. Excavation: Any underground trenching requirements shall be discussed with the National Park Service Park representatives and Project Manager(s) prior to any design submittal.

1.8. QUALITY ASSURANCE

- A. Design: Fire alarm plans and final specifications shall be developed in accordance with referenced codes, standards, by persons who are qualified and experienced in the design of fire alarm systems in accordance with NFPA 72, *National Fire Alarm Code equipment and personnel definitions* and at a minimum NICET level III or FPE.
- B. Installation Supervision: The fire alarm system installation supervisor shall be qualified and experienced in the design of fire alarm systems in accordance with NFPA 72, *National Fire Alarm Code equipment and personnel definitions*. This supervisor shall be trained and certified by the manufacturer of the equipment being installed, and there shall be minimum of one Fire Alarm NICET level II on-site throughout the installation.
- C. Record of Completion: Provide a fire alarm system Record of Completion in accordance with NFPA 72, *National Fire Alarm Code* signed by the most senior fire alarm installation supervisor.
- D. One Year Renewable contract for Inspection & Testing (IT). The IT shall include, but not be limited to, the requirements of NFPA 72.

1.9. WARRANTY

- A. Provide a warranty for the fire alarm system. The Contractor shall be responsible during the design, installation, testing and guarantee periods for any damage caused by the Contractor or Subcontractors, or by defects in the Contractor's or Subcontractors' work, materials or equipment. Warranty shall cover all materials, equipment, software, and installation provided by the contractor or subcontractor(s).
- B. Determine the cause of the fault condition, correct the faults and replace failing or malfunctioning components during the stated period of warranty. Warranty shall not apply to Government's failure to protect, handle, operate, or maintain system properly.
- C. Warranty period is for one (1) year following time of system acceptance.

1.10. EXTRA MATERIALS.

- A. General: Provide, at or before acceptance, extra materials that match products installed (as described below), packaged with protective covering for storage, and identified with labels clearly describing contents. The materials shall be inventoried with an itemized list given to the RSFMO and Representative. Provide the minimum specified quantity, but no less than one of each type:
  1. Keys: five (5) manual fire alarm box keys on the bottom of the Main FACP as spares.
  2. Smoke Detectors, Fire Detectors, and Heat Detectors: 15% of number of units of each type installed.
  3. Detector Bases: 15% of number of units of each type installed.
  4. Notification Appliances: 15% of number of each type installed.
  5. Interface (monitor & control) Modules or Relays: 15% of number of each type installed, but

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not less than 2 each.

6. Printer Paper: 3 extra boxes.
7. Program: CD copy of the complete fire alarm program. Include all keys, codes, and passwords to access and use program to its fullest extent.
- B. Unless otherwise specified, any surplus materials, fixtures, articles or equipment remaining at the completion of the project shall remain the property of the government, except those items furnished by the contractor, the cost of which is not included in the contract price.
- C. Panel Information: Provide the following information at the Main FACU, all remote fire alarm control units, and NAC power supply booster panels:
  1. The location and circuit identification number of the electrical distribution panel and circuit breaker for primary power serving the FACU.
  2. A copy of the "Record of Completion".
  3. Matrix of operation in graphical form. Matrix to show all alarm and supervisory input devices on the left side and all possible indications of the fire alarm system across the top. This matrix shall be laminated and permanently affixed to the panel.
  4. Single page instruction sheet in laminated plastic cover on how to acknowledge a trouble, supervisory, and alarm signal, and reset the panel. Affix permanently to panel.

## PART 2- PRODUCTS

### 2.1. GENERAL

- A. The system shall be of the analog addressable type.
- B. All equipment and system components furnished and installed shall be new and listed for their intended use. The equipment and system components shall be installed in accordance with the applicable codes and standards, the manufacturers' recommendations and within the limitations of the applicable listings.
- C. System components shall be modular in design to provide future expansion (10% minimum) capability of the system. Expansion capability shall pertain to capacity and quantities of devices, circuits, and primary and secondary power supplies.

### 2.2. CIRCUITS

- A. Fire alarm signaling line circuits (SLC) shall be Class "A" or "X" as described in NFPA 72, *National Fire Alarm Code*.
- B. Fire alarm notification appliance circuits may be Class "A" or "X" as described in NFPA 72, *National Fire Alarm Code*. Audible and visible notification appliances shall be installed on separate circuits.
- C. The system digital/data (riser) signaling line circuit shall be Class "A" or "X". The outgoing and return circuits shall be run in two separate conduits, physically separated by at least one-hour fire-resistive construction or routed in separate rooms, and arranged such that severing one of the conduits will not put any portion of the system out of service.
- D. Circuits extending to separate buildings containing an Out-Building FACU shall be Class "A" or "X" circuits, routed separately.

<p><b>NOTE:</b> It may be desirable to use optical fiber cables for these circuits. The Contractor should select the transmission technology based on cost and availability. Discuss with RSFMO staff before designing the system.</p>
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2.3. MAIN FIRE ALARM CONTROL UNIT

A. Features. The main fire alarm system controls shall:

1. Be addressable and network capable.
2. Be capable of supporting optical fiber network communications without the use of third party interfaces (no connection to RS-232 cards) as an integral component of the fire alarm control unit.
3. Be provided with a minimum 80-character screen or LCD.
4. Incorporate programmable function means, such as a momentary key operated switch or keypad.
5. Have a means for de-energizing the alarm notification appliances (both audible and visual). The means shall be key-operated or located within a locked cabinet and shall be factory installed. Upon de-activation of notification appliances, any existing alarm shall be transferred to a visual indicator on the Main FACU and the Remote Command Console. Any subsequent alarms from other zones shall cause the alarm notification appliances to re-activate.
6. Support a system integral printer.
7. Shall receive and indicate common trouble with component address from remote power supplies (NAC extenders), and any other interconnected control units, including suppression system controls.
8. Shall be capable of reporting programmable signals to the Central Monitoring Station through a means identified in NFPA 72 Chapter 26 and acceptable to the RSFMO. The system shall provide point of address upon system fault or alarm conditions. (*exception – when fire alarm control unit is monitoring a foreign system*).

B. System Programming: Provide latest software revision. Programming shall be Microsoft Windows based. The system shall be configured with the most current software revision and provide two (2) copies of this software configuration in electronic format upon system acceptance. Locate one copy at the Main Fire Alarm System Controls, and deliver one copy to the RSFMO.

C. Capacity: The main fire alarm controls shall be sized so that panel addresses used will not exceed 80% of rated maximum system addresses, evenly distributed throughout available circuits.

D. System power supplies:

1. Primary power supply – AC Power

The primary power supply for all control units and NAC extender panels:

- a. Shall be obtained from a dedicated branch circuit connected to the building standby power system, where one exists.
- b. Shall be installed and terminated in accordance with Chapters 1-4 of *NFPA 70, National Electrical Code*.
- c. Shall be provided with circuit breakers having a suitable guard or listed circuit breaker locking device that allows the toggle to trip under fault conditions.
- d. Shall be used only for the fire alarm system.

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- e. Shall be provided with surge protection at the power input to each cabinet.
  - f. Shall be identified as "FIRE ALARM CIRCUIT".
  - g. Location shall be permanently identified at the fire alarm control unit(s).
2. The secondary power supply for all control units and NAC extender panels:
- a. Shall consist of batteries or generator in accordance with NFPA 72
  - b. Shall supply energy to the system shall comply with NFPA 72 requirements under maximum quiescent load and at the end of that period shall be capable of operating all alarm notification appliances used for evacuation for not less than five (5) minutes or fifteen (15) minutes in accordance with NFPA 72.
  - c. Shall be sized at 130% of the calculated size to compensate for deterioration and additions.
  - d. Shall provide automatic battery-charging circuitry for each standby battery bank in the system. All FACU battery charge rates and terminal voltages shall be read using the fire alarm control panel LCD display in the service mode, indicating directly in volts and amperes, excluding NAC extender panels.
  - e. Shall be capable of recharging all secondary power supply batteries in 48 hours or less.

2.4. SYSTEM DEVICES

A. Initiating Devices.

- 1. Smoke Detectors: Analog addressable multi-sensor smoke detectors that can be programmed to use a combination of smoke, heat, and time for specific applications.
- 2. Heat Detectors: Shall be selected to operate at a temperature no less than 11 °C (20 °F) above the maximum expected ambient temperature.
- 3. Bases, Smoke and Heat Detectors: Shall be programmable through the use of switches on the base or detector. Separate programming units shall not be used.
- 4. Duct Smoke Detectors: Shall be of the addressable type, with a plug-in type detector head, duct mounted housing, and sampling tubes that provide air-flow through the duct housing.
- 5. Manual fire alarm boxes: Shall be of the addressable type and shall be single action and red in color.
- 6. Sprinkler supervisory and alarm initiating devices shall be installed, and connected to the fire alarm system under this contract.
- 7. Other initiating devices approved by the RSFMO.

B. Notification Appliances:

- 1. Visible notification appliances shall be UL1971 compliant and synchronized on each circuit. Visible notification appliances shall be multi-candela adjustable, red in color, and labeled "FIRE" with white letters.

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2. Audible notification appliances shall be ULI listed bells, and shall be red in color.
- C. Remote Control Console/Annunciator: Shall have a minimum 80-character display, shall be capable of acknowledge and reset functions, and shall be capable of initiating all programmed functions.
- D. Printer: A dot-matrix-type system printer or integral thermal-type printer shall be provided at the main FACP cabinet.

**NOTE:** An integral printer or dot matrix printer will be selected by the RSFMO, based on the conditions at the . Contact the RSFMO before submitting designs.

**(Discuss with RSFMO prior to submitting plans and selecting a system)**

- E. Interface Modules: Provide as required to effect fire safety functions and supervise/monitor other systems. All input/output interface modules shall be suitably rated for voltage and current they monitor or control.

## 2.5. CONDUCTORS

- A. Low Voltage System Wiring: Shall be installed as required by NFPA 70, *National Electrical Code*, Article 760, NFPA 72, and as follows:
  1. Initiating device circuits and signaling line circuits shall be wired using a minimum 18 AWG (1 mm), maximum 16 AWG (1.5 mm).
  2. Notification appliance circuits shall be wired using a minimum 14 AWG ( 1.9 mm), maximum 12 AWG (2.3 mm).
  3. All conductors shall be solid Copper. Stranded conductors shall not be used, unless specifically approved in writing by the RSFMO.
  4. Notification appliance circuit conductors shall be sized so that voltage drop does not exceed the minimum operating voltage requirements as identified on notification appliance nameplates.
  5. Provide surge suppression for all metallic circuits where exiting and entering any structure, connected prior to any system devices within the structure.
  6. Only Types FPL, FPLR, or FPLP cables shall be used, except between buildings.
  7. All conductors and conduit shall be suitable for the environment in which they are installed.
    - a. Conductors between buildings shall be Aquaseal cable, or equal.
    - b. Conductors between buildings shall be installed in conduit suitable for the environment.
    - c. Prior to any excavation, the Park representatives shall be notified.
    - d. Underground runs shall be continuous with terminations Only at surge protection devices in approved junction box.
- B. Power Supply Wiring: Shall be installed as required by NFPA 72, NEC Chapters 1 - 4 and as follows:
  1. Conductors for building power (120 VAC and higher) circuits shall be solid #12 AWG (4 mm) minimum.
  2. Different color conductors for primary, neutral, and ground wire shall be used. The primary (hot) conductor shall be black, the neutral conductor shall be white, and the equipment-grounding conductor shall be green.

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3. All conductors shall be installed in conduit suitable for the environment.

C. Optical Fiber Cable:

1. Optical fiber cable shall be of a type recommended by the manufacturer of the interface to which it is connected.
2. Individual fibers shall be color-coded.
3. Splices shall use fusion-splicing techniques, unless otherwise recommended by the manufacturer.
4. All optical fiber cable and its associated conduit shall be suitable for the environment in which they are installed.

D. Signal Transmission: Shall be by copper wire or fiber optic only. Aluminum conductors shall not be used.

1. Optical fiber cable shall be powered by the fire alarm control panel.

2.7 REMOTE POWER SUPPLIES

Remote power supplies (NAC extenders) shall provide indication of common trouble at the Main Fire Alarm Control Unit.

**PART 3- EXECUTION**

3.1. INSTALLATION, GENERAL

- A. Installation: Install system in compliance with NFPA Standards referenced in Part 1 of this Specification Section.
- B. Schedule: The installation shall be completed within the approved schedule.
- C. Drawings: Maintain accurate as-built drawings at the work site throughout the installation process. RSFMO approved deviations from the shop drawings shall be recorded for development of the record drawing submittals.
- D. Fire Alarm Power Supply Disconnect: The fire alarm system power supply shall be red in color and labeled "FIRE ALARM." Identify the location of the disconnecting means by a placard mounted on FACP cabinet door.

3.2. FUNCTIONAL DESCRIPTION SYSTEM FUNCTIONS

- A. General Alarm: A fire alarm system general alarm shall have the following responses:
  1. Indicate general alarm condition at FACU and remote annunciators.
  2. Identify device and provide alphanumeric location of the source of the alarm at FACU and remote annunciators.
  3. Initiate audible and visible alarm signals throughout building, including all Slave and Sub-Slave system notification appliance circuits.
  4. Initiate control functions associated with the actuated device
  5. Notify Central Monitoring Station

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- B. Manual fire alarm boxes: Manual fire alarm boxes shall initiate a general alarm. All manual fire alarm boxes shall override maintenance bypass and alarm de-activating features.
- C. Smoke detectors: All area smoke detectors shall:
1. Initiate a general alarm.
  2. Initiate control of fans, dampers, door closure/release and other equipment as required to satisfy Code requirements.
- D. Audible Base combination Heat/Smoke detectors: Used in sleeping quarters dwelling environments and shall:
1. Initiate a localized alarm in the room of alarm event.
  2. Initiate a localized alarm in the room adjacent each side of the room of alarm event.
  3. Initiate a supervisory signal at the Main FACU.
  4. Two or more detector activations, or five minutes elapsed time without alarm acknowledgement, will transmit and alarm signal to central monitoring station and sound general alarm.
  5. Heat detector activation will initiate general alarm
  6. A general alarm condition will sound all audible bases, and notification appliances within the protected premises.
- E. Duct smoke detectors: Duct type smoke detectors shall:
1. Initiate a supervisory signal at the Main FACU.
  2. Initiate control of fans, dampers, door closure/release and other equipment through the FACU as required.
- F. Heat detectors: All heat detectors shall:
1. Initiate a general alarm.
  2. Initiate control of fans, dampers, door closure/release and other equipment as required.
  3. Transmit signal to central monitoring station.
- G. Magnetically Held Doors: The fire alarm system shall release magnetically held open doors.
1. All area smoke and heat detectors shall initiate door latching contact closed upon activation.
  2. The magnetic door holders shall remain de-energized until system reset.
- H. Elevator smoke detection: In addition to area smoke detector function, elevator lobby, hoistway (if required), and machine room detectors shall:
1. Actuate primary or secondary elevator capture and recall.
  2. Initiate control of fans, dampers, door closure/release and other equipment as required.
  3. Cause a separate and distinct visible annunciation to alert emergency personnel capable of operating "Fireman's Override" that the elevators are no longer safe to use where "Firefighter's Override" switches are installed.
- I. Elevator heat detection: Where hoistways and/or machine rooms protected with sprinklers, heat detectors in the top of elevator shafts and elevator machine rooms shall:
1. Be installed within 610 mm (2 ft) of each sprinkler head in the elevator machine room and hoistway.
  2. Be of a lower temperature rating than the sprinkler heads in the elevator machine room and hoistway.
  3. Initiate a general alarm.



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4. Provide the output "Heat Detector – Elevator Shunt" on alphanumeric message.
  5. Actuate power shunt to elevator controllers prior to activation of sprinkler heads to avoid wetting down of live electrical components.
- J. Elevator Shutdown Control Circuit Supervision: Control circuits to shut down elevator power shall be monitored for presence of operating voltage. Reference: NFPA 72, *National Fire Alarm Code*,
- K. Sprinkler Water Flow Switch:
1. Shall initiate general alarm.
  2. Shall initiate control of fans, dampers, door closure/release and other equipment as required.
- L. Supervisory Devices: Supervisory signal initiating devices shall initiate a supervisory signal upon actuation of any of the following:
1. Sprinkler valve supervisory switches.
  2. Fire pump supervisory devices.
  3. Fire protection water supply supervisory devices.
  4. Out-Building FACU systems.
  5. Elevator shunt power loss.
  6. Other supervisory devices.
- M. Notification Appliances:
1. Audible notification appliances shall be silenceable using the "Alarm Silence" function.
  2. Visible notification appliances (strobes) shall remain actuated after audible silence until control panel reset.
- N. Provide a means to enable system testing and maintenance functions as follows:
1. Disable all audible alarm notification appliances in case of alarm signal, including subsequent alarm.
  2. Disable all auxiliary fire alarm control features, including but not limited to elevator recall, fan shutdown, and smoke control.
  3. Initiate a trouble signal on the system.
  4. Display message indicating system partially disabled.
  5. Disconnect the Central Monitor Station, and provide a disable signal.
  6. Disable all automatic door/closure releases.
  7. *A sign shall be placed on the FACU that states "prior to using the bypass function, the Park Structure Fire Coordinator, and monitor station shall be notified."*
- O. Duration:
1. System will automatically resume normal function after not more than 4 hours.
  2. Full function of alarm system to be restored on system reset.
  3. Any manual alarm box shall override disabling function key.
- P. Labeling:
1. Shall be labeled as to function only on the interior of the panel.
  2. Shall not be labeled on the exterior of the panel/annunciator at main entrance.
- Q. The means shall be key-operated, behind a locked cover, or password protected.

### 3.3 FACU OPERATION SEQUENCE/INTERFACES:

A. Main FACU:

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1. Main FACU shall provide a general alarm signal throughout the building it serves.

B. Out-Building FACU: Systems located in other buildings:

1. The Out-Building FACU shall function as the main FACU in the building it serves.

2. An alarm on a Out-Building FACU shall initiate a supervisory signal on the Main FACU and display the event data from the out-building FACU.

3.4 EXISTING FIRE ALARM EQUIPMENT:

A. Fully Operational:

1. Existing equipment shall be maintained as fully operational at all times until new equipment has been tested and accepted by the RSFMO or Delegate.

B. As new equipment is installed, it shall be labeled "NOT IN SERVICE" until new equipment is accepted.

1. Tags from new equipment shall be removed when put into service, and existing fire alarm equipment shall be tagged "NOT IN SERVICE" until removed from building.

C. Equipment Removal:

1. After acceptance of new fire alarm system, all existing disconnected fire alarm equipment, accessible conduit, and wire shall be removed.

D. Package and legally dispose of the operational fire alarm and detection equipment that has been removed.

1. Damaged surfaces shall be patched and painted according to Annex A, Cutting, Patching and Painting Specification.

3.5 EQUIPMENT INSTALLATION

A. Manual fire alarm boxes:

1. Shall have operating handles between 1100 mm (42 in) and 1220 mm (48 in) above the finished floor throughout the installation.

2. Shall have address and device number identified on the exterior of the assembly with permanent labels, minimum 10 font print. Example: 2/5 indicates circuit 2, address 5.

B. Sprinkler System Water-Flow Detectors and Valve Supervisory Switches:

1. Shall be properly permanently identified at the Main FACU indicating location of devices.

2. Shall have the address or device number permanently identified on the exterior of the assembly.

3. Shall be initially adjusted to offer a 60 second time delay for actuation of a waterflow alarm.

4. Shall have address label and device type printed by machine on a permanent labels, minimum 10 font print visible from floor level where mounted above a ceiling or behind a wall panel. Example: 2/5 indicates circuit 2, address 5.

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C. Automatic (Smoke/Heat) Detectors:

1. Shall be listed and programmed for appropriate environment in which they are installed.
2. Shall have detector bases solidly and secured to withstand rotary, tensile, and compressive movement that might occur during detector removal and insertion.
3. Shall be supported independently of the ceiling assembly where installed on false ceilings with T-bar hanger assemblies.
4. Shall not be installed before controlled environments are established well after finished trim out of the buildings interior spaces that are protected by the fire alarm system. Any devices contaminated by construction debris from premature installation shall be discarded and replaced with new devices.
5. Shall have detector LED lights positioned so they are visible from the entry location of the protected area.
  - a. *Shall have address label and device type printed by machine on a permanent labels, minimum 10 font print visible from floor level where mounted above a ceiling or behind a wall panel. Example: 2/5 indicates circuit 2, address 5.*

D. Remote Indicators:

1. Shall supervise the status of area and duct detectors that are located in concealed areas that are not visible from floor level.
2. Shall be installed so they are visible from floor level.
3. Shall be mounted directly above the door that contains the inaccessible detector or at the nearest visible point for the end user.
4. Shall be marked with the same identification as the detectors they represent. Shall have address label and device type printed by machine on a permanent labels, minimum 10 font print visible from floor level where mounted above a ceiling or behind a wall panel. Example: 2/5 indicates circuit 2, address 5.

E. Audible Notification Appliances:

1. Shall be on a separate circuit from visual notification appliance circuits.
2. Shall have their tops above finished floor at heights of not less than 2300mm (90 in) and below finished ceilings at heights of not less than 152 mm (6 in)

F. Visual Notification Appliances:

1. Shall be on a separate circuit from audible notification appliance circuits.
2. Shall be mounted such that the entire lens is not less than 2030 mm (80 in) and not greater than 2430 mm (96 in) above finished floor.

G. Combined Audible/Visual Notification Appliances:

1. Shall be mounted such that the entire lens is not less than 2030 mm (80 in) and not greater

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than 2430 mm (96 in) above finished floor.

2. Shall be installed on back boxes, with device operating mechanism concealed.

H. Fire Alarm Control Unit (FACU):

1. Shall be surface mounted, with tops of cabinet(s) not more than 1828 mm (6 ft) above finished floor.
2. Shall be installed with 915 mm (3 ft) clearance in front of cabinet to open door for service.

I. Remote Command Console:

1. Shall be surface mounted in accessible location at nominal 1524 mm (5 ft) above finished floor to top of the unit.

3.6 WIRING INSTALLATION

A. Methods:

1. Except as otherwise required by NFPA 72 & 70 Code and/or these Specifications, the installation of fire alarm circuits shall conform to the requirements of Article 760 and raceway installation to the applicable sections of Chapter 3 of NFPA 70, *National Electrical Code*. Fire alarm circuit wiring shall be in conformance with Article 760 of NFPA 70, *National Electrical Code*.
2. Power-limited fire alarm (PLFA) circuits shall be installed in conformance with Parts A and C of Article 760 of NFPA 70, *National Electrical Code*.
3. Fire alarm wiring shall be in a dedicated raceway/conduit system and shall not be used for any other wiring.
4. Primary power circuits supplied to fire alarm system shall not be in the same conduit or raceway as alarm circuits.
5. Power-limited circuit (PLFA) wiring material and installation methods shall be by cable Types FPL, FPLR, or FPLP listed and marked in accordance with Section 760-71 of NFPA 70, *National Electrical Code* using wiring methods in accordance with 760-52 (B) of NFPA 70, *National Electrical Code*.
6. T-tap connections shall not be permitted on any circuits.
7. Wires connected together shall have the same color insulation. All connections shall be accessible for inspection and servicing and shall be clearly identified on the Contractor record drawing's.
8. All main network risers between control units shall be run un-spliced in continuous lengths between panels.
9. Fire alarm circuits installed in locations other than ordinary indoor, dry locations shall be in conformance with Sections 760-3 and 760-7 of NFPA 70, *National Electrical Code* with conductor or cable types suitable for the installation conditions (e.g., Aquaseal or THWN for wet locations such as underground).
10. All wire shall be free from any mechanical failures, i.e., open circuits, shorts between conductors or shorts to earth ground. Evidence of electrical tests shall be provided as required

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under Section 3.13.

11. All cables and conductors shall be installed in conduit suitable for the location in which it is installed.

B. Grounding:

1. Equipment, equipment grounding conductors, and cable shields shall be grounded according to manufacturer's recommendations and NFPA 70, *National Electrical Code*. Shielded Type FPL cable shall have shields or drain wire tied through devices and junction boxes, isolated (insulated) from ground except at the FACP.
2. Grounding shall comply with Article 250 of NFPA 70, *National Electrical Code*.

C. Marking:

1. All electrical circuits shall be identified at both ends with wire marking tape.
2. Conductor numbering shall correspond with the zone or circuit numbers (i.e., wire #Z17 will be connected to zone #17, S3 will be connected to signaling line circuit 3).
3. Spare conductors shall be marked with numbers beginning with 200.
4. All notification or control devices (bells, door controls, etc.) shall be identified with markings that begin with a letter followed by sequential numbers for additional circuits as follows:

a.	Signaling Line Circuits:	S1, S2, S3, etc.
b.	Initiating Device Circuits:	Z1, Z2, Z3, etc.
c.	Audible Notification (Horn) Circuits:	B1, B2, B3, etc.
d.	Visible Appliance (strobe) Circuits:	V1, V2, V3, etc.
e.	Door Control Circuits:	D1, D2, D3, etc.
f.	Network Data Riser Circuit	R1

3. Direct current polarity shall be observed. Black insulated wire shall be negative, red shall be positive. Any exceptions shall be specifically approved in writing by the RSFMO.

D. Splices/Terminations:

1. Where used, circuits with shielded wire shall have shield (ground) or drain wire spliced and insulated continuously through the circuit. Splice in an approved manner, consistent with manufacturer's recommendations. Insulate shield/drain wire from ground except for connection only at the FACU common chassis ground.
2. Each terminal shall be marked according to wiring diagrams of system.
3. Conductors shall be installed parallel with or at right angles to sides and back of enclosures.
4. Conductors shall be neatly bundled, laced, and trained to terminal points with no excess lengths.
5. Conductors shall be run between equipment without splices, unless approved in writing by the RSFMO.

E. Risers and Network Communications:

1. All network communications shall be in a dedicated conduit.

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2. Class A & Z network communications shall have separate outgoing and return conduit paths.
3. All main network riser wiring between control units shall be run un-spliced in continuous lengths between panels, and shall not be spliced at riser junction boxes.
4. All optical fiber cables shall have strain relief and support.

F. Between Buildings:

1. Circuits extending to separate buildings containing an Out-Building FACU shall be Class A or Z circuits, routed separately in separate conduits.

**NOTE:** It may be desirable to use optical fiber cables for these circuits. Separate trenches may or may not be practical or possible. The Contractor should select the transmission technology and routing based on cost and availability. Discuss with RSFMO or Delegate before designing the system.

2. Provide surge protection where copper conductors exit and enter buildings. Protection shall be provided as near the point of entry as practicable.

3.7 CONDUIT:

- A. The number of conductors in any conduit shall conform to NFPA 70, *National Electrical Code*. Conduit fill shall not exceed 40%.
- B. All conduit shall be suitable for the conditions in which it is installed.
- C. All conduit shall be minimum 19 mm (¾ inch trade size). Surface mount raceway, where approved, shall be minimum 13 mm (½ inch trade size).
- D. Junction/pull boxes shall be installed such that there are no more than the equivalent of four-quarter bends (360 degrees total) between pull points.
- E. Intermediate junction pull boxes shall be installed as necessary, located a maximum of 100 feet apart.
- F. All fire alarm system conduit shall be identified by a minimum 25 mm (1 in) wide red stripe at intervals not exceeding 3 m (10 ft).
- G. All conduit penetrations through fire rated walls, corridor walls, floors, and mechanical/electrical room walls shall be sealed with fire rated sealant.
- H. When multiple buildings are to be connected by conduit runs, and conduit is exposed to the elements or buried underground, the conduit shall be rigid metallic conduit or rigid nonmetallic conduit. All conduit installed above grade shall be in rigid metallic conduit.
- I. Where the conduit is exposed to adverse climatic conditions, provide weatherproof conduit, electrical boxes and connectors.
- J. Where conduit is imbedded in plaster or masonry, use a type approved by NFPA 70, *National Electrical Code* for this use. Continuous runs of conduit without joints shall be required where imbedded in plaster or masonry.
- K. All conduit, junction boxes and enclosures subject to moisture shall be weatherproof (NEMA 3 or 4) where exposed to damp or wet locations as defined in Article 100 of NFPA 70, *National Electrical Code*.
- L. Flexible Metal Conduit (FMC) shall be limited to lengths of 2 m (6 ft) feet or less, unless approved in writing by the RSFMO.

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- M. Surface mount raceway shall be used in finished areas, where concealment of conductors is impractical or impossible.
- N. All penetrations through fire rated walls or assemblies shall be properly sealed to maintain the existing rating integrity of the wall or assembly.

### 3.8 JUNCTION BOXES:

#### A. All Junction Boxes:

- 1. All splices or terminations inside the junction box shall be made in accordance with Section 3.6.C of these specifications.
- 2. Wiring shall be labeled and identified with zone or circuit it represents.
- 3. Junction boxes shall be painted red in color.
- 4. Label boxes using stenciled exterior lettering in white or silver paint "FIRE ALARM.

#### B. Riser Junction Boxes: In addition to the above, riser junction boxes shall:

- 1. Be located in electrical or telephone spaces. Riser junction boxes shall not be located in stairways unless specifically approved in writing by the RSFMO.
- 2. Be readily accessible for maintenance personnel.
- 3. Be painted red in color.
- 4. Have numbers corresponding to the floor location (e.g. "BOX NO. 0" is in the basement, "BOX NO. 1" is the ground floor, "BOX NO. 2" is on the second floor). Junction boxes shall be labeled accordingly.
- 5. Have a wire directory listing on the inside cover.
- 6. Be 300 mm (12 in) by 300 mm (12 in) by 100 mm (4 in) minimum, sized appropriately according to number of conductors contained within and shall employ terminal strips for all connections.

### 3.9 PRE-TESTING

- A. Prior to requesting for system acceptance/commissioning activities, perform a 100%pretest in accordance with NFPA 72.
  - 1. Record all test results.
  - 2. Repair or replace and retest any device or component that fails pre-testing.

### 3.10 CLEANING AND ADJUSTING

- A. Cleaning: Devices shall not be cleaned. Any devices contaminated by construction debris, dust etc. shall be discarded and replaced with new devices.
- B. Patching: All walls and surfaces shall be restored to original condition and finish, including intended fire resistance rating.

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3.11 TRAINING

- A. Manufacturer's factory-authorized service representative shall provide services to demonstrate and train Service maintenance personnel after completion of commissioning as specified below:
1. Provide eight (8) hours of operational, maintenance, and troubleshooting training on the fire alarm system to Service maintenance personnel.
  2. Provide at least three one (1) hour of fire system operational training sessions to the primary user of the system, typically the Ranger and/or the Facility staff.

3.12 INSPECTION AND TESTS

- A. Provide:
1. Written certification the equipment has been inspected and tested by a manufacturer's certified representative.
  2. Written certification the equipment is installed in accordance with the manufacturer's recommendations and ULI listings.
  3. Written certification the equipment is in proper working order.
  4. Completed Record of Inspection and Testing form(s) as outlined in NFPA 72.
  5. Extra Materials required by Section 1.10 of these specifications.
  6. All required test equipment, including, but not limited to:
    - a. Heat producing devices (acceptable to manufacturer) for testing heat detectors.
    - b. Electrical test equipment, such as multi-meters
    - c. Smoke generating device for functional test, acceptable to manufacturer.
- B. The RSFMO or their delegate will visit the job site to witness final acceptance tests when advised by the Contractor that the work is completed and ready for test. If the work has not been completed or the final acceptance tests are unsatisfactory, the Contractor shall be responsible for the Government's extra expenses for re-inspection and witnessing the re-testing of the work. Such extra fees shall be deducted from the payments made by the Government to the Contractor.
- C. A contractor representative shall be present at the site until the RSFMO, or their representative has accepted the system.
- D. Provide at least thirty (30) working days notice prior to conducting all final tests.
- E. All Contractor testing shall conform minimally to the requirements of NFPA 72. Contractor testing shall include 100 percent of all devices, appliances, interfaced systems and control unit functions. Record the results of all tests, Inspection & Testing Form. Contractor's representative during commissioning / final acceptance testing shall be at a minimum NICET Level 2 certified.



Last Revised: December 17, 2012

**SCOPE OF WORK  
FOR  
A WATER-BASED FIRE PROTECTION SYSTEM  
(Dry Pipe Fire sprinkler System)**

**PART 1 – GENERAL**

**1.1 PROJECT DESCRIPTION**

A. The work consists of providing a new/modifying an existing automatic dry pipe water-based fire suppression system, buried and aboveground distribution piping and other related items for complete coverage of a [ \_\_\_\_ ] story historic structure . The system shall be designed and installed in accordance with National Fire Protection Association codes and standard identified in this specification and National Park Service standards.

**1.2 LOCATION**

A. The project is located in the [ \_\_\_\_ ] district of [ \_\_\_\_ ] National [ \_\_\_\_ ].

**1.3 SPECIAL PROCEDURES**

A. All work including but not limited to architectural, mechanical, electrical and structural shall be performed with extreme care to avoid damage to existing materials to remain or materials to be removed and reinstalled. Where “hot work” (open flame, grinding, welding, brazing, smelting) is required the Contractor shall apply for, and have on site at all times, a valid National Park Service hot work permit.

B. The authority having jurisdiction (AHJ) is the National Park Service Southeast Region Structural Fire Management Officer.

**1.4 MINIMAL DAMAGE**

A. It is the intent of this project to maintain the historic and non-historic finishes and materials with “minimal damage” due to the work. Minimal damage is defined as removal and replacement with the same removed material without discernible damage to the material or no more than one small hole that is less than two (2) inch square in any one foot square area. Damaged materials shall be replaced with similar or in kind materials, as approved by the Contractor Officer.

B. Where required the Contractor shall provide temporary service for utilities that are disrupted by work. Contractor shall coordinate all temporary service disruptions with the NPS and other contractors on site. Contractor shall notify the Contracting Officer [ \_\_\_\_ ] hours/days prior to any planned utility interruptions.

C. Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage.

## 1.5 QUALITY ASSURANCE

A. All work shall comply with the applicable requirements of this specification and the codes, standards, and entities identified in section 1.8 of this specification, and applicable state and local codes.

B. Where required by applicable NFPA codes and standards or this specification, devices and equipment shall be UL listed or FM approved.

C. Qualifications:

Designer/Installer: Company specializing in design and installation of water-based fire suppression systems.

1. Experience: Continuously designed and installed water-based fire suppression systems in state of [ \_\_\_\_\_ ] for five years.

2. Designer: Registered professional fire protection engineer in state of [ \_\_\_\_\_ ] or a certified NICET Level III Automatic Sprinkler System Layout Technician.

3. Contractor shall be certified by the material/equipment manufacturer as trained in, and as knowledgeable of, the manufacturer's standard practice and procedure relating to installation of sprinkler systems. The Contractor shall be certified and licensed by the state and local jurisdictions, as applicable.

4. Contractor shall be a firm specializing in performing work of this section with a minimum of five years experience and must be regularly engaged in the installation of water-based fire suppression systems.

5. Contractor shall have successfully installed automatic water-based fire suppression systems of the same type and design as specified herein. The Contractor shall provide evidence of such qualifications. The data shall include:

- a. Names
- b. Locations of at least three installations where the Contractor has installed such systems.
- c. The Contractor shall indicate the type and design of each system and certify each system has performed satisfactorily in the manner intended for a period of not less than 12 months.
- d. The Contractor shall submit a copy of a valid state sprinkler contractor certificate and license, as applicable.

D. Personnel:

1. Design: All fire sprinkler plans submittals, to include shop drawings and working plans, shall be developed in accordance with codes and standards identified in this specification by a Fire Protection Engineer registered in the State of [ \_\_\_\_\_ ], or a certified NICET Level III Automatic Sprinkler System Layout Technician.
2. Installation Supervision: The sprinkler system installation supervisor shall be qualified and experienced in the design and installation requirements of sprinkler systems in accordance with NFPA 13 and state requirements.
3. Contractor shall provide workers normally employed in the field and as otherwise specified in the specification and NFPA 13.

E. Where required by this specification or NFPA 13 equipment and components shall bear the UL and/or FM label or marking.

F. Other Requirements:

1. The design, equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of this specification and NFPA 13 and other applicable NFPA codes.
2. The advisory provisions (Annexes) of the NFPA publications referred to herein shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears. If there are any conflicts between these specifications and the referenced standards and publications, the most stringent requirement shall apply.
3. The Contractor shall coordinate with the NPS and all trades and contractors on the site to ensure that the final installation of the water-based fire suppression system meets the minimum installation requirements of NFPA 13.

## 1.6 REFERENCES

A. National Fire Protection Association (NFPA)

1. NFPA 13 (Standard for the Installation of Sprinkler Systems – 2013 Edition)
2. NFPA 14 (Standpipe for the Installation of Standpipe and Hose Systems - 2010 Edition)
3. NFPA 20 (Standard for the Installation of Stationary Pumps for Fire Protection - 2010 Edition)
4. NFPA 22 (Standard for Water Tanks for Private Fire Protection - 2009 Edition)
5. NFPA 24 (Standard for the Installation of Private Fire Service Mains and Their Appurtenance - 2007 Edition)
6. NFPA 25 (Inspection, Testing and Maintenance of Water-Based Fire Protection Systems - 2013 Edition)
7. NFPA 70 (National Electrical Code - 2011 Edition)
8. NFPA 72 (National Fire Alarm Code - 2013 Edition)

9. NFPA 101 (Life Safety Code - 2012 Edition)
10. NFPA 170 (Standard for Fire Safety and Emergency Symbols – 2009 Edition)
11. NFPA 291 (Recommended Practice for Fire Flow Testing and Marking of Hydrants - 2010)

B. International Code Council

1. International Building Code – 2009 edition
2. International Fire Code – 2009 edition

C. Underwriters Laboratories, Inc. (UL)

1. UL-193 Alarm Valves for Fire-Protection Service
2. UL-199 Automatic Sprinklers for Fire-Protection Service
3. UL-1468 Direct Acting Pressure Reducing and Pressure Restricting Valves

D. Factory Mutual System (FM)

1. FM Approval Guide - 2003 edition

E. American National Standards Institute (ANSI)

1. ANSI/ASME B1.20.1 - Pipe Threads, General Purpose
2. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
3. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300
4. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250
5. ANSI/ASME B16.5 - Steel Pipe Flanges and Flanged Fittings
6. ANSI/ASME B16.9 - Factory-made Wrought Steel Butt-welded Fittings
7. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-Welded and Threaded
8. ANSI/ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
9. ANSI/ASME B16.25 - Butt-welded Ends for Pipe, Valves, Flanges, and Fittings
10. ANSI/ASME B36.10M - Wrought Steel Pipe

F. American Society for Testing and Materials (ASTM)

1. ASTM A53 - Welded and Seamless Steel Pipe
2. ASTM A126 - Gray Iron Castings for Valves, Flanges, Pipe Fittings
3. ASTM A135 - Electric-Resistance-Welded Steel Pipe
4. ASTM A183 - Carbon Steel Track Bolts and Nuts
5. ASTM A193 - Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
6. ASTM A194 - Carbon and Alloy Steel Nuts and Bolts for High Pressure and High-Temperature Service
7. ASTM A197 - Cupola Malleable Iron
8. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
9. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
10. ASTM F436 - Hardened Steel Washers
11. ASTM A536 - Ductile Iron Castings
12. ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

G. American Welding Society (AWS)

1. AWS D10.9 - Specification for Qualification of Welding Procedures and Welders for Piping and Tubing

#### H. American Water Works Association (AWWA)

1. AWWA C104 - Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
2. AWWA C110 - Ductile Iron and Gray Iron Fittings, 3-in. through 48-in. for Water and Other Liquids
3. AWWA C111 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
4. AWWA C115 - Flanged Ductile Iron Pipe and Threaded Flanges
5. AWWA C150 - Thickness Design of Ductile Iron Pipe
6. AWWA C151 - Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
7. AWWA C153 - Ductile Iron Compact Fittings, 3-in. through 12-in., for Water and Other Liquids
8. AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances

### 1.7 DEFINITIONS

AHJ: Authority Having Jurisdiction. The Authority Having Jurisdiction is the National Park Service Southeast Region Structural Fire Management Officer

ALARM SIGNAL: Signifies a state of emergency requiring immediate action. Pertains to signals from operation of an alarm initiating device.

APPROVED: Acceptable to the Authority Having Jurisdiction.

AUTOMATIC FIRE ALARM SYSTEM: A system providing an emergency function without the necessity of human intervention and activated as a result of a predetermined temperature rise, or increase in level of products of combustion, in accordance with the minimum requirement of NFPA 72.

CO: Contracting Officer

COR: Contracting Officer's Representative

DRY PIPE SPRINKLER SYSTEM: A sprinkler system employing automatic sprinklers that are attached to a piping system containing air or nitrogen under pressure, the release of which (as from the opening of a sprinkler) permits the water pressure to open a valve known as a dry pipe valve, and the water then flows into the piping system and out the opened sprinklers.

FIRE PROTECTION SPRINKLER CONTRACTOR: A person or company engaged in the planning, sale, installation, repair, alteration, addition, maintenance, or inspection of fire protection sprinkler systems or water spray systems.

FLOW: The flow rate of the water from the source under flow conditions.

GRADE: Lowest point of elevation of the finished surface of ground, paving, or sidewalk with the area between the building and property line.

**HAZARDOUS AREA/ROOM:** An area in a structure of building used for the process or storage that involves highly combustible, flammable, or explosive products or other material which may present a potential danger to life, health, property through fire, explosion, etc.

**HISTORIC STRUCTURE:** A building deemed to have historical, architectural, or cultural significance by regional or national jurisdiction.

**HYDRAULICALLY DESIGNED SYSTEM:** A calculated sprinkler system in which pipe sizes are selected on a pressure loss basis to provide a prescribed water density, in gallons per minute per square foot (min), or a prescribed minimum discharge pressure or flow per sprinkler, distributed with a reasonable degree of uniformity over a specified area.

**NICET:** National Institute for Certification in Engineering Technologies

**NPS:** National Park Service

**PIPE SCHEDULE SYSTEM:** A sprinkler system in which the pipe sizing is selected from a schedule that is determined by the occupancy classification and in which a given number of sprinklers are allowed to be supplied from specific sizes of pipe.

**RESIDUAL PRESSURE:** The pressure available from the source under flow conditions.

**SPRINKLER SYSTEM:** For fire protection purposes, an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The installation includes one or more automatic water supplies. The portion of the sprinkler system aboveground is a network of specially sized or hydraulically designed piping installed in a building, structure, or area, generally overhead, and to which sprinklers are attached in a systematic pattern. The valve controlling each system riser is located in the system riser or its supply piping. Each sprinkler system riser includes a device for actuating an alarm when the system is in operation. The system is usually activated by heat from a fire and discharges water over the fire area.

**STATIC PRESSURE:** The pressure available from the source when no water is flowing to the system.

**SUPERVISORY SIGNAL:** Indicates abnormal status or need for action regarding fire suppression or other protective system, such as a control valve supervisory/tamper switch.

**TROUBLE SIGNAL:** Indicates that a fault, such as an open circuit or ground, has occurred in indicating appliance circuit, initiating device circuit, or internal to FACP.

**WATER-BASED FIRE SUPPRESSION SYSTEM (FIRE SPRINKLER):** A system of overhead and underground piping to protect the interior or exterior of a building or structure from fire where the primary extinguishing agent is water.

**WATERFLOW ALARM DEVICE:** A mechanical device mounted on the sprinkler pipe that has a paddle internal to the sprinkler pipe to monitor the water for flow. This device is typically monitored by the building fire alarm system.

## 1.8 SYSTEM DESCRIPTION

Provide automatic dry pipe fire sprinkler system in all areas of the building/areas indicated on the drawings, and shall provide for complete fire protection coverage in accordance with required and annex provisions of NFPA 13 for uniform distribution of water. The dry pipe sprinkler system shall be hydraulically designed to provide densities as described in this specification. Activation of waterflow switches shall annunciate an alarm condition at the sprinkler monitoring panel or fire alarm control panel. Valve tamper and circuit trouble conditions shall be annunciated at the sprinkler monitoring panel or fire alarm control panel as supervisory and trouble conditions, respectively. Sprinkler protection shall be provided based on the hazard classifications in this specification and NFPA 13.

### B. Private Service Main:

Contractor shall design and install a private fire service main and connect it to the existing water distribution system. The fire service main shall be designed and installed in accordance with applicable sections of this specification and the minimum requirements of NFPA 13 and 24.

### B. Private Water Distribution System for Fire Suppression:

Contractor shall design and install a private water distribution system consisting of a water storage tank, private fire service main, fire hydrants, fire pump, and other applicable appurtenances. The Contractor shall tie the sprinkler system to the new water distribution system. The water distribution system and fire service main shall be designed and installed in accordance with applicable sections of this specification and the minimum requirements of NFPA 13, 20, 22, and 24.

## 1.9 SYSTEM COMPONENTS COMPLIANCE

A. Performance requirements for the fire sprinkler will be determined by a review of construction submittals and by field inspection. Compliance review shall be performed by the AHJ, or his/her designee. Compliance review is to verify that the Design/Build Contractor is providing systems, products, and/or materials that will satisfy the stated criteria. This review shall not relieve the Design/Build Contractor from responsibility for any errors or omissions, nor from responsibility for complying with the requirements of the project contract, this specification, or NFPA 13.

## 1.10 HYDRAULIC SYSTEM DESIGN PARAMETERS

### A. Hazard Classifications

#### 1. Light Hazard:

Provide sprinklers hydraulically designed to provide a minimum density of 0.10 gallons per minute per square foot over 1500 square feet of floor area, for a minimum of 30 minutes. Water supply calculation will include 100 gpm for inside and outside hose streams.

2. Ordinary Hazard (Group 1):

Provide sprinklers hydraulically designed to provide a minimum density of 0.15 gallons per minute per square foot over the hydraulically most remote 1500 square feet of floor area, for a minimum of 60 minutes where the sprinkler system is remotely electronically supervised and monitored off site (90 minutes is not remotely monitored). Water supply calculation will include 250 gpm for inside and outside hose streams.

3. Ordinary Hazard (Group 2):

Provide sprinklers hydraulically designed to provide a minimum density of 0.20 gallons per minute per square foot over the hydraulically most remote 1500 square feet of floor area, for a minimum of 60 minutes where the sprinkler system is remotely electronically supervised and monitored off site (90 minutes if, not remotely monitored). Water supply calculation will include 250 gpm for inside and outside hose streams.

B. Hydraulic Design Requirements:

1. Sprinkler Discharge Area:

The discharge area for each system shall be the hydraulically most remote area as defined in NFPA 13 and as stated for the occupancies referenced above.

2. Friction Losses:

Losses in pipe shall be calculated in accordance with the Hazen-Williams formula with "C" values in accordance with NFPA 13.

3. A minimum 10 pounds per square inch safety margin over the required pressure shall be incorporated into all hydraulic calculations.

4. If the system minimum requirements can not be met, it is the responsibility of the contractor to identify alternative options with costs and discuss with the AHJ.

C. Water Supply:

1. Contractor shall be responsible for performing waterflow test to determine the performance of the water distribution system. Flow tests shall be performed on the two fire hydrants closest to the facility in which the dry pipe sprinkler is to be installed.

The following information is required:

Hydrant 1

Location: \_\_\_\_\_

Static Pressure \_\_\_\_ psi

Residual Pressure \_\_\_\_ psi

Hydrant 2 (Flow Hydrant):

Location: \_\_\_\_\_

Gallons per Minute (Flow) \_\_\_\_ gpm



2. Water delivery times shall comply with the following:

<u>Hazard Type</u>	<u>No of Most Remote Sprinkler Initially Opened</u>	<u>Maximum Time of Water Delivery</u>
Light	1	60 Seconds
Ordinary I	2	60 Seconds
Ordinary II	2	50 Seconds

D. Location and spacing of sprinklers in relation to the ceiling, light fixtures, ventilation equipment, storage, ceiling fans, and soffits, shall not exceed that permitted by NFPA 13 and the listing of each sprinkler. The spacing of sprinklers on the branch lines for open areas shall be uniform.

E. Drain pipes shall be 2 inch and valves shall be installed on the system to allow drainage. The system shall drain to the maximum extent possible through the main drain valve. Discharge from the drain pipe shall be to the building exterior, directed away from the building and stair. The discharge from the drain pipe shall be piped to within 8 inches of grade. Splash blocks under the drain outlet shall be provided to prevent soil erosion. Discharge to sump pumps, floor drains, sinks and waste lines, etc. is not permitted.

#### **1.11 PIPE SCHEDULE SYSTEM DESIGN PARAMETERS**

A. Pipe schedule method shall be permitted only for new installations of 5000 sq. ft. or less or for additions or modifications to existing pipe schedule systems sized according to the pipe schedules of the appropriate chapter of NFPA 13.

B. The pipe schedule method shall be permitted for use in systems exceeding 5000 sq. ft. where the flows required by the appropriate chapter of NFPA 13 are available at a minimum residual pressure of 50 psi at the highest elevation of sprinkler.

C. Pipe schedule system shall meet the minimum flow and pressure requirements of NFPA 13.

D. The number of sprinklers on each given pipe size shall meet NFPA 13 requirements.

E. Extra hazard occupancies shall be hydraulically calculated.

F. The pipe schedule method shall be permitted for additions or modifications to existing extra hazard pipe schedule systems.

#### **1.12 SUBMITTALS**

A. The AHJ shall review and "accept/reject" or take other appropriate action on the Contractor's submittals including shop drawings, samples, documentation and as-built drawings. This review is to verify conformance to project specifications and design concepts expressed in the contract documents. The AHJ is allotted 20 working days to review and approve/reject each submittal.

B. Meeting and Submittal Schedule: The Contractor shall be responsible for preparing and submitting a project schedule using MS Project v2000 or later at the start of the project and during the project if necessary to update the project's progress. The following information outlines the project milestones and completion period.

1. Notice to Proceed (NTP)	Project Start
2. Submit Project Schedule	7 days after NTP
3. 50% Design Submittal	90 Days after NTP
4. Plans-In-Hand Meeting of 50% Submittal	14Days after 50% Design Submittal
5. NPS Review Comments for 50% Submittal Design Submittal	21 Days after 50% Design Submittal
6. Contractor Response to NPS Review Comments	7 Days after NPS Review Comments
7. 100% Design Submittal	30 Days after Contractor response to NPS Review Comments*
8. NPS Review Comments for Design Submittal	14 Days after receipt of 100% Design Submittal
9. Contractor Response to NPS 100% Review Comments	7 Days after NPS Review Comments
10. 100% Final Submittal	21 Days after Contactor response*

\* This timeframe is based on mutual acceptance of comments and responses.

C. Shop Drawings:

1. Contractor shall prepare and submit a minimum of four (4) complete sets of detailed shop drawings indicating the proposed layout of equipment, mains, risers, hangers, pipes and sprinklers.
2. Drawings shall be drawn to scale, not less than 1/8-inch equals 1-foot, on sheets not smaller than 24 inches x 36 inches, in accordance with all requirements for "Working Drawings (Plans)" as specified in NFPA 13.
3. Drawings shall comply with the "Plans and Calculations" chapter of NFPA 13 and contain all applicable information found therein.

4. Drawings shall be stamped/sealed by a fire protection engineer registered in the State of [ \_\_\_\_\_ ], or a certified NICET Level III Automatic Sprinkler Layout Technician.

5. Drawings shall show hydraulic reference points with hydraulically most remote areas clearly shown, and proof by example that area shown is in fact the hydraulically most remote.

D. Design Data:

1. Contractor shall submit for approval to the COR calculations, and other information for the dry pipe sprinkler system, stamped/sealed and signed by professional fire protection engineer registered in the State of [ \_\_\_\_\_ ] prior to beginning any work.

E. Product Data

1. Submit four (4) complete sets of descriptive data (manufacturer's cut sheets) marked-up to show the specific model, type and size of each item proposed. Full descriptive data shall be submitted for all components essential to proper installation, including, but not limited to: sprinklers, pipe, fittings, gate valves, butterfly valves, check valves, backflow devices, hangers, flow switches, tamper switches, materials and other associated equipment.

2. Prepare and submit a minimum of four (4) complete sets of hydraulic calculations.

F. Project Record Documents

1. Contractor shall prepare, on a daily basis, red-lined shop drawings to record as-built conditions. Submit completed red-line drawings to the Contracting Officer and the AHJ at project completion.

2. Prepare and submit four (4) sets of record shop drawings, product data, and hydraulic calculations reflecting final as-built conditions at completion of project, but before final acceptance of the work. These documents shall be prepared in accordance with the requirements for the initial submittal. Freehand sketches or mark-up documents are not acceptable. Record drawings shall be on reproducible media.

G. Operations and Maintenance Data:

1. Furnish four (4) sets of instruction manuals containing complete operation and maintenance instructions for the specific make and model of check valves, control valves, waterflow switches, valve supervisory switches, control panels, and other components supplied. Include maintenance data relative to components of the system, servicing requirements, inspection data, replacement part numbers and availability, and location and numbers of the service depot.

#### H. Contractor's Material and Test Certificates

1. Upon completion of required testing the contractor shall submit completed and signed material and test certificates for aboveground, underground piping and backflow prevention devices certifying system meets or exceeds the specified requirements. The Contractor shall use the following National Park Service forms:

- Aboveground Piping Acceptance Test Form (Form AS-5)
- Underground Piping Acceptance Test Form (Form AS-4)
- Backflow Prevention Assembly Test Form (Form BF-1)
- Fire Pump Acceptance Form (Form FP)
- Fire Hydrant Acceptance & Flow Test Form (Form FH-1)
- Fire Alarm Record of Completion and Acceptance Form (FA-2)

#### I. Final Acceptance Test

1. Contractor shall propose procedures for final acceptance test, no later than [14] days prior to the proposed start of the tests. Contractor shall submit final acceptance test procedures at the same time proposed final acceptance test date and time are submitted. Notification shall include a copy of the Contractor's Material and Test Certificates. The AHJ or designee shall witness final acceptance testing.

### 1.13 DELIVERY, STORAGE AND HANDLING OF MATERIALS

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. It is the responsibility of the contractor to maintain all parts in a safe, secure place until installation.
- C. The storage location must meet the approval of the CO.
- D. Provide temporary protective coating on cast iron and steel valves during the storage period.
- E. All stored pipe shall be support off the ground at all times.

### 1.14 GUARANTEE

- A. The Contractor, in addition to other warranties or guarantees required by the contract documents, shall guarantee workmanship on all piping, devices, and related materials for a period of one year from the date of the Contracting Officer's final acceptance of the work. All defects shall be promptly corrected at no cost to the Owner.
- B. The Contractor is responsible for providing a system that has been coordinated with the contract documents and approved by the Contracting Officer.

## PART 2 - PRODUCTS

### 2.1 GENERAL

A. The Contractor shall provide all labor and materials for a complete NFPA 13 compliant dry pipe fire sprinkler. All equipment supplied under this specification shall be new and, where required by the NFPA or this specification, shall be UL-listed or FM-approved for fire protection systems and installed and used as intended by the listing.

B. The Contractor shall design and install a fire protection system and shall connect the system to the [existing/new private/public](#) water main in such a way that the shutdown of the facility potable water line will not shutdown the fire sprinkler water supply. Connection to the existing water service shall be made with a dielectric flange union. Provide a double check valve backflow prevention assembly with listed valves.

C. Sprinkler System:

1. Contractor shall provide a hydraulically designed dry pipe automatic sprinkler system. The sprinkler system shall provide complete sprinkler coverage of the building.

2. Where the volume of any individual system piping exceeds 500 gallons the contractor shall provide a quick-opening device. The maximum system capacity controlled by one dry pipe valve shall not exceed 750 gallons. The calculated volume of each system shall be indicated on the sprinkler system shop drawings.

3. Contractor shall verify the performance limits of the existing water distribution system by performing a water flow test, using the two hydrants that are closest to the facility to be protected. The water flow test shall be performed in accordance with NFPA 291. The results of the water flow test shall be provided to the AHJ for review prior to the completion of sprinkler system design.

4. Upright, pendent, and sidewall sprinkler shall be installed as approved by the AHJ. Recessed dry pendent sprinklers shall be installed in all finished ceiling areas. Dry sidewall sprinklers may be used where authorized and approved by the AHJ.

5. The sprinkler riser main drain and shall be routed to the exterior of the building. Contractor shall provide a splash block or rip-rap below the discharge outlet of all drain outlets to prevent erosion.

6. Sprinkler system design criteria shall be based on this specification and the occupancy hazard classification section of NFPA 13.

7. Where more than 20 heads are required a fire department connection is required.

8. Contractor shall provide and install a spare sprinkler box, near the riser, that contains spare sprinkler heads of all head types used in the system; the number of which shall be in accordance with NFPA, and a sprinkler wrench.

9. Contractor shall install a sprinkler monitoring panel/fire detection and notification system, or connect sprinkler water flow and tamper switches to the existing fire detection and notification panel. Water flow switch activation shall trigger a fire alarm condition at the fire alarm control panel. Tamper switch activation shall trigger a supervisory alarm condition at the fire alarm control panel.

10. Sprinkler system design shall include materials, accessories, and equipment inside and outside building, to include all fittings, valves, sprinklers, specialty items, and appurtenances required for a complete and operable water-based fire suppression system to provide system complete and ready to use.

11. Paint all interior exposed ferrous metal piping and ferrous metal pipe supports with installed in tenant spaces with one coat primer and two coats of corrosion resistant exterior enamel. Finish paint color shall match surrounding surfaces. Paint color shall be approved by the Contracting Officer.

12. Contractor shall provide NFPA 13 compliant labels and signs for all system control valves and drains.

13. Contractor shall attach an NFPA 13 compliant hydraulic design plate to the system riser.

## **2.2 UNDERGROUND PIPING**

- A. Underground pipe shall be UL-listed or FM-approved for fire protection systems.
- B. The pressure class of the pipe, joints, fittings, valves and hydrants shall not be less than the maximum working pressure of the system under non-emergency (no-flow) conditions. In no case shall the pressure class be less than 175 pounds per square inch.
- C. Ductile iron pipe shall be joined by approved means.
- D. Fittings shall be cast iron or ductile iron listed and/or approved for fire main underground installations.

## **2.3 ABOVEGROUND PIPING SYSTEMS**

- A. Pipe shall be per NFPA 13. Schedule 10 pipe or smaller will not be approved. All steel pipe shall be hot dip galvanized Schedule 40.
- B. Fittings shall be cast iron, or malleable iron, or steel conforming to NFPA 13 requirements.
- C. Branch lines shall be pitched at least half ( $\frac{1}{2}$ ) in. per 10 ft and mains shall be pitched at least one-quarter ( $\frac{1}{4}$ ) in. per 10 ft.

## 2.4 SPRINKLERS

- A. The Contractor shall indicate on the contract drawings the type of sprinkler heads for each area if more than one type of sprinklers is to be provided. Delete sprinkler types from this paragraph that are not intended for use in the system(s) used in the contract.
- B. Sprinklers with internal O-rings **will not be allowed**.
- C. Sprinklers shall be used in accordance with their listed coverage limitations.
- D. Temperature classification shall be ordinary or intermediate, as appropriate and approved by the AHJ.
- E. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13.
- F. Extended coverage sprinklers shall be allowed, as approved by the AHJ.
- G. Pendent sprinkler heads shall be the dry pendent type.
- H. Pendent sprinkler shall be of the fusible strut or glass bulb type, **recessed**, quick-response type. Pendent sprinklers shall have a polished **chrome/stainless steel/white polyester** finish. Assembly shall include an integral escutcheon.
- I. Upright sprinkler shall be **brass/chrome-plated/stainless steel/white polyester**, quick-response type.
- J. Where corrosion resistant sprinkler are required by NFPA 13 (i.e., where chemicals, moisture, or other corrosive vapors sufficient to cause corrosion of such devices exists), or as required by the AHJ, they shall be **upright/pendent** type installed in appropriate locations, in accordance with NFPA 13, or as required by the AHJ. Corrosion resistant coatings shall be factory-applied by the sprinkler manufacturer.
- K. Sprinklers in areas with finished ceilings shall be recessed, unless otherwise instructed by the COR or AHJ.
- L. Dry pendent sprinklers shall be of the required length to permit the sprinkler to be threaded directly into a branch line tee, and to permit entirely concealing the dry sprinkler barrel.
- M. Hangers shall be provided on arm-overs exceeding 12 inches in length.
- N. Dry pendent sprinkler assemblies shall be such that sprinkler ceiling plates or escutcheons are of the uniform depth throughout the finished space.
- O. Install pendent sprinklers in suspended ceilings a minimum of 6 inches from ceiling grid. Install recessed pendent sprinklers such that the distance from the sprinkler deflector to the underside of the ceiling does not exceed the manufacturer's listed range and is of uniform depth throughout the finished area.
- P. Sprinklers in areas without finished ceilings shall be upright, brass, unless otherwise specified.

- Q. Sprinklers shall be U.L. listed for the intended application.
- R. Sprinklers subject to mechanical damage shall be properly protected with listed guards, in accordance with the requirements of NFPA 13.
- S. Sprinklers shall not be painted in the field. The Contractor shall ensure proper protection is provided to prevent the painting of sprinklers by other trades and contractors. Any sprinklers that have been painted shall be replaced by the Contractor with new listed sprinklers of the same characteristics, including orifice size, thermal response, and water distribution.

## **2.5 SPRINKLER MONITORING AND WATER FLOW ALARMS**

- A. A sprinkler pressure (Waterflow) alarm switch shall be installed and shall include a metal housing with a neoprene diaphragm, SPDT snap action switches and a 1/2 inch NPT male pipe thread. The switch shall have a maximum service pressure rating of 175 psi. There shall be two SPDT (Form C) contacts factory adjusted to operate at 4 to 8 psi. The switch shall be capable of being mounted in any position in the alarm line trim piping of the dry pipe valve.
- B. Activation of any water flow switch shall cause an audible alarm on premises within 5 minutes of the flow of water across said device and shall continue until the flow of water is terminated.
- C. Where a control valve is installed between the initiating device and the notification appliance, i.e. a ball valve is installed on the water motor gong or water flow switch piping, and the system is required to be monitored by this scope, NFPA 13 or NFPA 72, the control valve shall also be monitored.
- D. Where sprinkler monitoring panels or fire alarm control panels monitor sprinkler system components the panel shall be capable of transmitting a signal to an approved central/remote station within 90 seconds of water flow or supervisory switch activation.
- E. Valve Supervisory Switches: Provide sprinkler control valves with approved supervisory (tamper) switches. The supervisory signal shall be obtained during the first two revolutions of the hand wheel or operating crank. The switch shall not interfere with the operation of the valve nor obstruct the view of its indicator. Devices shall be compatible with the fire alarm control panel or sprinkler monitoring panel, where existing or proposed, and the requirements of NFPA 72. All switches shall be suitable for installation as end-of-line devices.
- F. Low air pressure and high pressure alarms shall be provided.
- G. Where the system is monitored by a sprinkler monitoring panel or fire alarm control panel the Contractor shall connect the low air pressure and high air pressure supervising switches to the panel.



H. The air pressure switches shall initiate a trouble signal when the pressure above the dry pipe valve increases or decreases by 10 psi above the dry pipe valve trip point pressure. The switch shall have an adjustable range between 5 psi and 80 psi. The switch shall have screw terminal connection and shall be capable of being wired for normally open or normally closed circuit.

I. The high air pressure switch shall be set to activated in accordance with manufacturer recommendations, or shall be 20 psi in excess of the calculated trip pressure of the dry pipe valve, based on the highest normal water pressure of the system supply.

## **2.6 GAUGES**

A. A listed pressure gauge shall be installed immediately below the control valve of each system.

B. Pressure Gauges: Pressure gauges shall be the a metal corrosion-resistant case, liquid filled, flat glass window, 3½-inch diameter with background dial with black markings, and a 0-300 pounds per square inch gauge range. Gauge accuracy shall be 3-2-3 percent of full range. A shut-off valve shall be provided with each gauge connection.

C. A pressure gauge with a connection not smaller than one-quarter (¼ ) in. shall be installed at the system main drain, at each main drain associated with a floor control valve, and on the inlet and outlet side of each pressure reducing valve.

D. Each gauge connection shall be equipped with a shutoff valve and provisions for draining.

E. The required pressure gauges shall be listed and shall have a maximum limit not less than twice the normal system working pressure at the point where installed.

F. Gauges shall be installed to permit removal and shall be located where they will not be subject to freezing.

## **2.7 FIRE DEPARTMENT CONNECTION**

A. Fire Department Connection: The fire department connection (FDC) shall be a projecting, single port or Siamese (Y-type), with cast brass body, and shall be provided with sign lettered "Automatic Sprinkler." The FDC inlet(s) shall have individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2½-inch diameter threads compatible with the local fire department. The FDC shall be located on the exterior wall of the facility. The FDC installation shall include a 4-inch swing-type check valve, or as determined by hydraulic calculation. A ball drip assembly shall be provided with the drain piped outdoors.

B. The pipe must be hot dipped galvanized inside and out, and externally coated and wrapped.

## 2.8 BACKFLOW PREVENTION ASSEMBLY

A. Backflow Preventer: Provide double detector check valve assembly backflow preventer with gate valves. The entire assembly (check valves and gate valves) shall be listed for fire protection systems. Each check valve shall have a drain. Backflow prevention assemblies shall have current "Certificate of Approval" from the Foundation for Cross-Connection Control and Hydraulic Research. Means shall be provided downstream of all backflow prevention valves for flow tests at system demand.

B. All indicating control valves that are apart of the backflow prevention assembly that are also used as the main water supply control valves to the sprinkler system shall be listed for fire protection systems and mechanically or electronically supervised in accordance with NFPA 13, 72, and this scope of work.

C. Testing, to include forward flow testing, of backflow prevention devices shall be in accordance with section 3 of this scope of work and the appropriate chapter of NFPA 25.

## 2.9 VALVES

A. All valve assemblies shall meet or exceed the requirements as outlined by NFPA 13.

B. Provide valves as required by NFPA 13 and of types approved for fire service. Sprinkler control valves shall open by counterclockwise rotation and be OS&Y or butterfly type. Valves 2 inches and smaller shall be bronze. Valves 2½ inches and larger shall be iron bodies, bronze mounted.

C. Dry Pipe Valve

1. The dry pipe valve shall be resettable from the outside.

2. The dry pipe valve shall be a latching differential type, and shall be complete with trim piping, valves, fittings, pressure gauges, priming water fill cup, velocity drip check, drip cup, and other ancillary components as required for proper operation. The assembly shall include a quick-opening device by the same manufacturer as the dry pipe valve for systems over 500 gallons in capacity.

D. Gate Valves

1. Up to and including 2 inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc.

2. Over 2 inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, resilient-seated.

E. Globe Valves

1. Up to and including 2 inches: Bronze body, bronze trim, rising stem and handwheel, inside screw.

2. Over 2 inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug type disc, renewable seat and disc.

#### F. Ball Valves

1. Up to and including 2 inches: Bronze one-piece body, stainless steel ball, Teflon seats and stuffing box ring, lever handle and balancing stops. Over 2 inches: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged.

#### G. Butterfly Valves

1. Bronze body, stainless steel disc, and resilient replaceable seat, threaded ends, extended neck, handwheel and gear drive and integral indicating device, and built in tamper proof switch for signal transmission to the fire alarm system.

2. Cast or ductile iron body, chrome plated ductile iron disc, resilient replaceable EPDM seat, extended neck, handwheel and gear drive and integral indicating device and built-in tamper proof switch for signal transmission to the fire alarm system.

#### H. Underground Valves

1. All valves controlling connections to water supplies and to supply pipes to sprinklers shall be listed indicating valves. Such valves shall not close in less than 5 seconds when operated at maximum possible speed from fully open position.

2. A non-indicating valve such as an underground gate valve with approved roadway box, complete with T-wrench shall be permitted.

3. Post Indicating Valve (PIV) shall be permitted.

#### I. Check Valve:

1. Provide a listed/approved swing-type check valve in the sprinkler system riser assembly prior to any branch lines. A backflow prevention device listed for water-based fire protection systems shall be allowed, as approved by the AHJ.

### 2.10 DRAINAGE

1. Provide main drain piping to discharge outside the building to a point approved by the AHJ.

2. All piping shall be arranged where practicable to drain to the main drain valve.

3. Branch lines shall be pitched at least half ( $\frac{1}{2}$ ) in. per 10 ft and mains shall be pitched at least one-quarter ( $\frac{1}{4}$ ) in. per 10 ft.

4. Provide auxiliary drains as required by NFPA 13.

5. Auxiliary drain controls shall be of the Metraflex Never♦Trip™ valve assembly, or approved equal.

6. Where the capacity of trapped sections of pipe is less than 5 gal, the auxiliary drain shall consist of a valve not smaller than one-half ( $\frac{1}{2}$ ) in.

7. Where the capacity of isolated trapped sections of system piping is more than 5 gal, the auxiliary drain shall consist of two 1-in. valves and one 2-in. × 12-in. condensate nipple or equivalent, and accessibly located.
8. Auxiliary drains shall not be used on pipe drops supplying dry-pendent sprinklers.
9. Provide tie-in drains for multiple adjacent trapped branch pipes, a minimum of 1 inch in diameter. Pitch tie-in drain lines a minimum of 1/2 inch per 10 feet.

## **2.11 AIR SYSTEM**

### **A. Air Compressor**

1. Compressor shall be single stage oil-free type, air-cooled, electric-motor driven, equipped with a check valve, shutoff valve and pressure switch for automatic starting and stopping. Pressure switch shall be factory set to start the compressor at 30 psi and stop it at 40 psi. Provide a safety relief valve, set to operate at 65 psi.
2. The air supply shall have a capacity capable of restoring normal air pressure in the system within 30 minutes.
3. The air compressor power cord shall be anchored to an electrical outlet with a set screw or hardwired, in accordance with NFPA 70, to a circuit off of the closet electrical sub-panel.

### **B. Air Pressure Maintenance Device**

1. Device shall be a pressure regulator that automatically reduces supply air to provide the pressure required to be maintained in the piping system. The device shall have a cast bronze body and valve housing complete with diaphragm assembly, spring, filter, ball check to prevent backflow, 1.6 mm 1/16 inch restriction to prevent rapid pressurization of the system, and adjustment screw. The device shall be capable of reducing an inlet pressure of up to 100 psig to a fixed outlet pressure adjustable to 10 psig.

### **C. Air Supply Piping System**

1. Configure system so that each dry pipe system is equipped with a separate pressure maintenance device, air compressor, shutoff valve, bypass valve and pressure gauge. Piping shall be galvanized steel in accordance with ASTM A 795 or ASTM A 53/A 53M.
2. The connection pipe from the air compressor shall not be less than 1/2 inch in diameter and shall enter the system above the priming water level of the dry pipe valve. A check valve shall be installed in the system supply air piping from the compressor. A shutoff valve of the renewable disc type shall be installed upstream of this check valve. The air supply system shall be sized to pressurize the sprinkler system to 20 psi above the supply side pressure within 20 minutes.

## **2.12 INSPECTOR'S TEST CONNECTION**

A. Provide test connection(s) approximately 6 feet above the floor. Provide test connection piping to a location where the discharge will be readily visible or provide a test connection with sight glass assembly. The test piping shall discharge to exterior grade and onto a splash block so as to prevent damage to the structure or landscape.

B. System, main drain or sectional drains, connections piping shall be routed to a location where the discharge will be readily visible. The test piping shall discharge to exterior grade and onto a splash block so as to prevent damage to the structure or landscape.

## **2.13 PIPE HANGERS AND SUPPORT**

A. Pipe hangers, braces and supports shall be in accordance with NFPA 13.

B. Hangers for support of piping and equipment shall be types approved for fire protection service. Supports including all threaded rods shall not interfere with access to operating areas, obstruct electrical junction boxes, or impact the reliability and operations of facility equipment and systems. In areas subject to earthquakes additional seismic bracing will be required on all hangers and installed according to NFPA 13 and the IBC.

## **2.14 PIPE SLEEVES**

A. Systems requiring galvanized pipe: For sleeves in masonry and concrete walls, floors and roofs provide, Schedule 40 or standard weight, hot-dip galvanized steel pipe sleeves.

B. Systems requiring galvanized pipe: For sleeves in partitions, and other than masonry and concrete walls, floors and roofs provide hot-dip galvanized steel sheet having a nominal weight of not less than 0.90 pounds per square foot.

## **2.15 PIPE ESCUTCHEON PLATES**

A. Provide approved one piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed areas. Provide [chromium-painted finish, or white painted finish escutcheon plates, as approved by the AHJ](#), in finished areas. Securely anchor plates in place with set screws or other approved means.

## **2.16 RISER ROOM**

A. Room which supports the sprinkler riser shall not be subject to temperatures below 40 degrees Fahrenheit. Where these conditions may exist, provisions shall be made to comply with NFPA 13.

B. The Contractor shall provide a riser room temperature monitoring device, Potter RTS, or approved equal, and wire the device to the sprinkler monitoring or fire alarm control panel.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Coordinate work of this section with the COR or his/her designee.
- B. The Contractor shall take any necessary measures to prevent damage to the facilities and equipment, and shall take any necessary measures to prevent accidental water discharge at all times. All collateral damage resulting from the work and testing under this section, whether intentional or not, shall be repaired by the Contractor at no cost to the government.
- C. At any time "Hotwork" is being performed by the contractor a valid NPS Hot Work permit shall be on site.
- D. At anytime an existing fire protection system is disabled by the contractor the contractor is responsible for notifying COR and the building occupants, and for establishing a fire watch until the fire protection system is restored to normal conditions. Under no circumstances shall a fire protection system be let out of service overnight.
- E. The Contractor is responsible for the safe work place environment for their employees and contractors. The contractor shall comply with the OSHA standards.
- F. Ream pipe and tube ends to remove all burrs.
- G. All excess oil, dirt, pipe joint compound, rust, and mill scale shall be removed from piping and equipment. All dirt, debris and excess cutting oil shall be removed from the interior of all piping and equipment before it is erected.
- H. Cap off open newly installed pipe at the end of each work day to prevent insects, rodents or other potential obstructions from entering the pipe.
- I. Storage of equipment, tools, and materials is the sole responsibility of the Contractor. Arrangements shall be made with the COR prior to work.
- J. Storage of material shall be stacked in an orderly fashion and meet the satisfaction of the COR. The storage shall be safeguarded to prevent accidents from occurring around the stored material.
- K. Piping shall be inspected by, tested in the presence of, and approved by the AHJ or his designee before covering, or concealing. Provide fittings for changes in direction of piping and for all connections. Make changes in pipe sizes through tapered reducing pipe fittings; the use of bushings will not be permitted. This should be Part 3 Execution.
- L. Welding shall be performed in the shop; field welding will not be permitted.
- M. Where possible and as approved by this the COR, the Contractor shall conceal piping, fittings, fixtures, hangers and supports in areas with suspended ceilings and finished areas.

N. Piping joined by threaded methods shall be Schedule 40 for sizes less than 8-inch pipe.

O. Pipe shall be joined by threaded or cut grooved, welded or flanged methods.

### 3.2 INSTALLATION

A. All work shall be installed in a professional manner (parallel/perpendicular to walls and columns) in accordance with NFPA and NPS standards and other applicable standards referenced by this document. All piping in areas with finished ceilings shall be concealed, unless otherwise approved by the COR.

B. Install all equipment in accordance with manufacturer's instructions.

C. Use proper lubricant on ends of piping or gaskets where required by pipe fitting or coupling manufacturer. The manufacturer's recommended lubricant shall be used.

D. Where required by manufacturer, properly torque bolts to manufacturer's specifications using a torque wrench.

E. Prevent electrolyses by insulating connection between pipe, fittings, hangers or dissimilar metal against direct contact. Use dielectric insulating flanges and units.

F. Support all sprinkler piping, risers, etc., as specified in NFPA 13 and 24. Provide riser clamps above floor at each floor penetration.

G. Provide minimum 1¼-inch diameter, 4-inch long nipples and caps at ends of all cross mains for flushing connections.

H. Sprinkler installation shall be coordinated with the installed mechanical and electrical work and the ceiling grid/layout. Where sprinklers are to be installed on modular ceiling panels, sprinklers shall be located as close to the center of the ceiling panel in both directions as possible. The Contractor shall furnish additional sprinklers, which may be required for coordinated ceiling pattern without additional cost to the NPS, even though number of sprinklers may exceed minimum code requirements.

I. The Contractor shall install the piping and equipment in accordance with approved shop drawings.

J. Main and Auxiliary Drains:

1. Each system shall be furnished with a main drain, which is capable of draining the majority of the system to outside grade. Drainage to floor or sink is not permitted.

2. Auxiliary drains shall be provided to drain any sections of piping that trap water or are not capable of being drained by the main drain in accordance with NFPA 13. Auxiliary drains shall discharge as required by NFPA 13 and the AHJ.

3. All drains terminating outside shall be piped to within 8 inches of finished grade. Concrete splash guards shall be provided at grade level beneath all outside drains. Drainage shall not create damage to the facility or surrounding landscape.

- K. The Contractor shall install seismic bracing in accordance with NFPA 13.
- L. The Contractor shall install proper UL-listed firestopping materials as required for any penetrations through fire rated construction.
- M. Tapping or drilling of load-bearing structural members is not permitted. Attachments may be made to steel or concrete structures with approved clamps and hangers designed in accordance with NFPA 13 and local standards.
- N. Provide pipe sleeves where piping passes through walls, floors, roofs, and partitions. Grout sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide clearance between exterior of piping and interior of sleeve in accordance with NFPA 13. Firmly pack space with noncombustible insulation and caulk at both ends of the sleeve with plastic waterproof cement, which will dry to a firm but pliable mass, or provide a flexible seal. Extend sleeves in floor slabs 3 inches above the finished floor.
- O. Install valves with stems upright or horizontal as required. Valve stems shall not be inverted.
- P. Provisions shall be made by the Contractor to protect piping, sprinklers and other components of the sprinkler systems from extreme climatic conditions including freezing and high temperature (under 40° F, or over 100° F).
- Q. Install exposed piping so as not diminish exit access widths, corridors, or equipment access. Install exposed horizontal piping, including drain piping to provide maximum headroom.
- R. All control valves shall have signs identifying their function per NFPA 13 requirements.
- S. In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, conceal piping above ceilings, inspect, test piping and obtain approval before it is covered up. Conceal risers and similar vertical runs of piping in finished areas.
- T. Caution signs shall be attached to all valves controlling sprinkler. The caution sign shall be worded as follows:

***Caution:***

*This valve controls fire protection equipment.*

*Do not close until after fire has been extinguished.*

*Use auxiliary valves when necessary to shut off supply  
to auxiliary Equipment*

***Caution:*** *Automatic alarm will be sounded if this valve is closed*



### 3.3 TESTING

A. Inspection test procedures shall be submitted to AHJ for approval prior to performance of test.

B. The Contractor shall make provisions for the proper disposal of water used for flushing or testing. Diversion of flush and test water onto the ground or into drains or waterways is not approved.

C. Hydrostatically tests all piping and attached appurtenances, to include the piping between the exterior fire department connection and the check valve in the fire department connection inlet pipe, subjected to working pressure at 200 psi or 50 psi above normal operating pressure where the normal operating pressure is greater than 150 psi. The pressure shall be maintained for a period of two (2) continuous hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

D. The Contractor shall hydraulically and mechanically pre-test all installed components in accordance with NFPA 13 acceptance test protocols to ensure proper installation and operations prior to scheduling the AHJ system acceptance test.

E. All acceptance testing performed by the Contractor shall be conducted in the presence of the AHJ or his designated representative, and other representatives at the option of the NPS. All persons concerned shall be notified two (2) weeks in advance of the tests in order to arrange attendance at the tests.

F. Final acceptance testing shall begin only after the preliminary test report has been approved by the AHJ. The Contractor shall conduct the final acceptance test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. Each system shall be completely drained after each trip test. The system air supply system shall be tested to verify that system pressure is restored in the specified time. In addition, the Contractor shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

G. Testing of aboveground piping shall consist of an air pressure leakage test at 40 psi for 24 hours. There shall be no drop in gauge pressure in excess of 1.5 psi for the 24 hours. This air pressure test is in addition to the required hydrostatic test.

H. The contractor is required to complete and submit all applicable acceptance forms to include:

- Aboveground Piping Acceptance Test Form (Form AS-5)
- Underground Piping Acceptance Test Form (Form AS-4)
- Backflow Prevention Assembly Test Form (BF-1)
- Fire Alarm Record of Completion and Acceptance Form (FA-2)

I. Backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams. Provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, playpipe nozzles, calibrated pressure gauges, and Pitot tube gauge. Provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, record the pressure readings and pressure drop (friction) across the assembly. Provide a metal placard on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. Compare and report the pressure drop to the manufacturer's data. Testing shall include:

- A forward flow test shall be conducted at the designed flow rate, including hose stream demand, of the system, where hydrants or inside hose stations are located downstream of the backflow preventer.
- A backflow performance test, as required by the authority having jurisdiction, shall be conducted at the completion of the forward flow test.
- For backflow preventers sized 2 in. (50 mm) and under, the forward flow test shall be acceptable to conduct without measuring flow, where the test outlet is of a size to flow the system demand.
- Where water rationing is enforced during shortages lasting more than 1 year, an internal inspection of the backflow preventer to ensure the check valves will fully open shall be acceptable in lieu of conducting the annual forward flow test.
- Where connections do not permit a full flow test, tests shall be completed at the maximum flow rate possible.
- The forward flow test shall not be required where annual fire pump testing causes the system demand to flow through the backflow preventer device.

J. Testing each alarm initiating device, including pressure alarm switch, low air pressure switch, valve supervisory switch for proper operation. Test water motor alarm or electric bell. Inspect and test the connecting circuit to the building fire alarm system.

K. Contractor shall perform an NFPA 13 compliant main drain flow test to verify the adequacy of the water supply. Contractor shall record static and residual pressures. In addition, conduct a main drain test each time after a main control valve is shut and opened.

L. Perform trip test of dry pipe valve in the presence of the AHJ or his/her designee by reducing normal system air pressure through operation of the inspector's test connection. Test systems equipped with quick opening devices without the operation of the quick opening device and then with it in operation. Test results will be witnessed and recorded. Test results shall include the number of seconds that elapsed between the time the test valve is opened and tripping of the dry valve; trip-point air pressure of the dry pipe valve; water pressure prior to valve tripping; and number of seconds elapsed between time the inspector's test valve is opened and water reaches the orifice.

M. Leaks in piping shall be immediately corrected. On threaded piping, tighten joints. If necessary, dismantle and replace section. Caulking, peening, or stop-leak compounds will not be permitted.

N. All operating parts, including electrical equipment, shall be fully tested to ensure their proper operation. All control valves shall be fully closed and opened under full system pressure.

O. All sprinkler alarm and supervisory devices shall be fully tested by the Contractor to ensure their proper operation and that they report appropriate signals to the fire alarm or sprinkler monitoring panel.

P. All gaps left by holes and or penetrations created for the installation of fire sprinkler piping, appurtenances, or wiring shall be patched or backfilled with an approved fire stop material or construction.

Q. The Contractor shall perform supplemental tests and shall render additional services in connection with the sprinkler system, as directed. The cost, if any, will be negotiated prior to the test. The effect of additional tests, if any, on the delivery schedule shall be determined prior to undertaking the test.

### **3.4 EXTRA MATERIALS**

A. Provide spare sprinklers under provisions of NFPA 13. The quantity of each type of extra sprinkler shall be as specified in NFPA 13.

B. Provide suitable wrenches for each type of sprinkler.

C. Provide metal cabinets for storage of spare sprinklers and sprinkler wrenches. Cabinets shall be of sufficient size to permit spare sprinklers to fit upright and be reasonably secured within the cabinets.

D. Cabinets shall be wall mounted adjacent to the sprinkler system riser, unless otherwise approved.

E. Provide two (2) of each type of key and/or special tool required for system use and maintenance, include access tools for waterflow and tamper switches.

### **3.5 PATCHING AND PAINTING (FINISH WORK)**

#### **A. Patching:**

1. Replacement or repair materials shall match those of the existing adjacent surfaces.
2. Finished surfaces shall be repaired to match existing finished surfaces.
3. All surfaces, walls, floors and ceilings shall be repaired to maintain their integrity and fire resistance.
4. Replace fireproofing material removed from structural steel with new fireproofing material of equal or better fire rating. New fireproofing material shall be acceptable to the COR.
5. New replacement ceiling tiles shall be supplied by the Contractor and shall match the existing tiles.

#### **B. Painting:**

1. All new paint colors and textures shall match those of the existing adjacent areas.
2. The Contractor shall repaint the entire existing ceiling and/or wall surface that has been altered or damaged or where soffits are added due to installation of new work.
3. Spot painting will be acceptable only if the painting matches the existing paint, to the satisfaction of the Contracting Officer or his/her designee. If the spot painting does not match, the Contractor shall repaint the entire contiguous surface.
4. Color and texture of finish coats shall match existing.
5. Color of priming coat shall be lighter than body coat.
6. Color of body coat shall be lighter than finish coat.
7. Primer and body coats shall be colored to mask surface imperfections and so they do not show through the finish coat.

#### **C. Paint Preparation:**

1. The Contractor shall thoroughly mix all painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
2. Finish paint shall not be used as primer. Primers must be matched to substrate being painted:
3. Dry wall - polyvinyl acetate primer latex.

4. Metal - primer required by manufacturer for proper adhesion.
5. Masonry - proper masonry sealer/primers to insure proper adhesion to substrate.

D. The Contractor shall not thin materials, unless necessary for proper application and when finish paint is used for body and prime coats. Materials and the quantities used for thinning shall be in accordance with the manufacturer's printed instructions.

E. The Contractor shall remove all paint skins, then strain paint through commercial paint strainer to remove all lumps and other particles.

F. Two-component and two-part paint and those requiring additives shall be mixed in such a manner as to be uniformly blended in accordance with the manufacturer's printed instructions.

G. The Contractor shall use color pigment recommended by the paint manufacturer for tinting required to produce exact shades specified.

### **3.6 PATCHING AND PAINTING (CLEAN-UP)**

A. Upon completion, the Contractor shall clean paint from all hardware, glass and other surfaces and items not required to be painted.

B. Before final inspection, any work that has become damaged or discolored shall be touched up or refinished by the Contractor in a manner to produce solid even color and finish texture, free from defects.

C. The Contractor shall be responsible for replacing and/or repairing any and all areas damaged during the execution of this work.

D. The areas of cutting, coring, demolition, debris removal, and painting; the inside and outside of the building shall be left in a safe and clean condition suitable for the installation of new work.

E. A steel sleeve of adequate size to allow an approximate 1-in. (25-mm) clearance between the sleeve and the pipe or raceway shall be provided for each pipe or raceway. The space between the sleeve and penetrating item (annular space) shall be filled as required to meet the fire rating. Joint reinforcement shall be provided in the horizontal mortar joints immediately above and below sleeves in concrete masonry walls, and all hollow spaces of concrete masonry walls immediately adjacent to the sleeve shall be filled with concrete, mortar, or grout.

**---END OF SECTION---**

Revised 6/25/2012

**SCOPE OF WORK  
FOR  
A WATER-BASED FIRE PROTECTION SYSTEM  
(Wet Pipe Fire sprinkler System)**

**PART 1 – GENERAL**

**1.1 PROJECT DESCRIPTION**

A. The work consists of providing a new/modifying and existing automatic wet pipe water-based fire suppression system, buried and aboveground distribution piping and other related items for complete coverage of a [ \_\_\_\_ ] story historic structure. The system shall be designed and installed in accordance with National Fire Protection Association codes and standard identified in this specification and National Park Service standards.

**1.2 LOCATION**

A. The project is located in the [ \_\_\_\_ ] district of [ \_\_\_\_ ] National [ \_\_\_\_ ].

**1.3 SPECIAL PROCEDURES**

A. All work including but not limited to architectural, mechanical, electrical and structural shall be performed with extreme care to avoid damage to existing materials to remain or materials to be removed and reinstalled. Where “hot work” (open flame, grinding, welding, brazing, smelting) is required the Contractor shall apply for, and have on site at all times, a valid National Park Service hot work permit.

B. The authority having jurisdiction (AHJ) is the National Park Service, Southeast Region, Structural Fire Management Officer.

**1.4 MINIMAL DAMAGE**

A. It is the intent of this project to maintain the historic and non-historic finishes and materials with “minimal damage” due to the work. Minimal damage is defined as removal and replacement with the same removed material without discernible damage to the material or no more than one small hole that is less than two (2) inch square in any one foot square area. Damaged materials shall be replaced with similar or in kind materials, as approved by the Contractor Officer.

B. Where required the Contractor shall provide temporary service for utilities that are disrupted by work. Contractor shall coordinate all temporary service disruptions with the NPS and other contractors on site. Contractor shall notify the Contracting Officer [ \_\_\_\_ ] hours/days prior to any planned utility interruptions.

C. Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinkler shall be installed over and under ducts, piping and platforms when such equipment can negatively effect or disrupt the sprinkler discharge pattern and coverage.

## 1.5 QUALITY ASSURANCE

A. All work shall comply with the applicable requirements of this specification and the codes, standards, and entities identified in section 1.8 of this specification, and applicable state and local codes.

B. Where required by applicable NFPA codes and standards or this specification, devices and equipment shall be UL listed or FM approved.

C. Qualifications:

Designer/Installer: Company specializing in design and installation of water-based fire suppression systems.

a. Experience: Continuously designed and installed water-based fire suppression systems in state of [ ] for five years.

b. Designer: Registered professional fire protection engineer in state of [ ] or a certified NICET Level III Automatic Sprinkler System Layout Technician.

c. Contractor shall be certified by the material/equipment manufacturer as trained in, and as knowledgeable of, the manufacturer's standard practice and procedure relating to installation of sprinkler systems. The Contractor shall be certified and licensed by the state and local jurisdictions, as applicable.

d. Contractor shall be a firm specializing in performing work of this section with a minimum of five years experience and must be regularly engaged in the installation of water-based fire suppression systems.

e. Contractor shall have successfully installed automatic water-based fire suppression systems of the same type and design as specified herein. The Contractor shall provide evidence of such qualifications. The data shall include:

1. Names
2. Locations of at least three installations where the Contractor has installed such systems.
3. The Contractor shall indicate the type and design of each system and certify each system has performed satisfactorily in the manner intended for a period of not less than 12 months.
4. The Contractor shall submit a copy of a valid state sprinkler contractor certificate and license, as applicable.

D. Personnel:

1. Design: All fire sprinkler plans submittals, to include shop drawings and working plans, shall be developed in accordance with codes and standards identified in this specification by a Fire Protection Engineer registered in the State of [ \_\_\_\_\_ ], or a certified NICET Level 3 Automatic Sprinkler System Layout Technician.
2. Installation Supervision: The sprinkler system installation supervisor shall be qualified and experienced in the design and installation requirements of sprinkler systems in accordance with NFPA 13 and state requirements.
3. Contractor shall provide workers normally employed in the field and as otherwise specified in the specification and NFPA 13.

E. Where required by this specification or NFPA 13 equipment and components shall bear the UL and/or FM label or marking.

F. Other Requirements:

1. The design, equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of this specification and NFPA 13 and other applicable NFPA codes.
2. The advisory provisions (Annexes) of the NFPA publications referred to herein shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears. If there are any conflicts between these specifications and the referenced standards and publications, the most stringent requirement shall apply.
3. The Contractor shall coordinate with the NPS and all trades and contractors on the site to ensure that the final installation of the water-based fire suppression system meets the minimum installation requirements of NFPA 13.

## 1.6 REFERENCES

A. National Fire Protection Association (NFPA)

1. NFPA 13 (Standard for the Installation of Sprinkler Systems – 2013 Edition)
2. NFPA 14 (Standpipe for the Installation of Standpipe and Hose Systems - 2010 Edition)
3. NFPA 20 (Standard for the Installation of Stationary Pumps for Fire Protection - 2010 Edition)
4. NFPA 22 (Standard for Water Tanks for Private Fire Protection - 2009 Edition)
5. NFPA 24 (Standard for the Installation of Private Fire Service Mains and Their Appurtenance – 2010 Edition)
6. NFPA 25 (Inspection, Testing and Maintenance of Water-Based Fire Protection Systems - 2011 Edition)
7. NFPA 70 (National Electrical Code - 2011 Edition)
8. NFPA 72 (National Fire Alarm Code - 2013 Edition)
9. NFPA 101 (Life Safety Code - 2012 Edition)
10. NFPA 170 (Standard for Fire Safety and Emergency Symbols – 2009 Edition)



11. NFPA 291 for water flow test, it should be included here.

B. Underwriters Laboratories, Inc. (UL)

1. UL-193 Alarm Valves for Fire-Protection Service
2. UL-199 Automatic Sprinklers for Fire-Protection Service
3. UL-1468 Direct Acting Pressure Reducing and Pressure Restricting Valves

C. Factory Mutual System (FM)

1. FM Approval Guide - 2003 edition

D. American National Standards Institute (ANSI)

1. ANSI/ASME B1.20.1 - Pipe Threads, General Purpose
2. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
3. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300
4. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250
5. ANSI/ASME B16.5 - Steel Pipe Flanges and Flanged Fittings
6. ANSI/ASME B16.9 - Factory-made Wrought Steel Butt-welded Fittings
7. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-Welded and Threaded
8. ANSI/ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
9. ANSI/ASME B16.25 - Butt-welded Ends for Pipe, Valves, Flanges, and Fittings
10. ANSI/ASME B36.10M - Wrought Steel Pipe

E. American Society for Testing and Materials (ASTM)

1. ASTM A53 - Welded and Seamless Steel Pipe
2. ASTM A126 - Gray Iron Castings for Valves, Flanges, Pipe Fittings
3. ASTM A135 - Electric-Resistance-Welded Steel Pipe
4. ASTM A183 - Carbon Steel Track Bolts and Nuts
5. ASTM A193 - Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
6. ASTM A194 - Carbon and Alloy Steel Nuts and Bolts for High Pressure and High-Temperature Service
7. ASTM A197 - Cupola Malleable Iron
8. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
9. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
10. ASTM F436 - Hardened Steel Washers
11. ASTM A536 - Ductile Iron Castings
12. ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

F. American Welding Society (AWS)

1. AWS D10.9 - Specification for Qualification of Welding Procedures and Welders for Piping and Tubing

G. American Water Works Association (AWWA)

1. AWWA C104 - Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
2. AWWA C110 - Ductile Iron and Gray Iron Fittings, 3-in. Through 48-in. for Water and Other Liquids
3. AWWA C111 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings

4. AWWA C115 - Flanged Ductile Iron Pipe and Threaded Flanges
5. AWWA C150 - Thickness Design of Ductile Iron Pipe
6. AWWA C151 - Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
7. AWWA C153 - Ductile Iron Compact Fittings, 3-in. through 12-in., for Water and Other Liquids
8. AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances

H. International Code Council

1. International Building Code – 2009 edition
2. International Fire Code – 2009 edition

## 1.7 DEFINITIONS

AHJ: Authority Having Jurisdiction. The Authority Having Jurisdiction is the National Park Service Southeast Structural Fire Management Officer

ALARM SIGNAL: Signifies a state of emergency requiring immediate action. Pertains to signals from operation of an alarm initiating device.

APPROVED: Acceptable to the Authority Having Jurisdiction.

AUTOMATIC FIRE ALARM SYSTEM: A system providing an emergency function without the necessity of human intervention and activated as a result of a predetermined temperature rise, or increase in level of products of combustion, in accordance with the minimum requirement of NFPA 72.

CO: Contracting Officer

COR: Contracting Officer's Representative

FIRE PROTECTION SPRINKLER CONTRACTOR: A person or company engaged in the planning, sale, installation, repair, alteration, addition, maintenance, or inspection of fire protection sprinkler systems or water spray systems.

FLOW: The flow rate of the water from the source under flow conditions.

GRADE: Lowest point of elevation of the finished surface of ground, paving, or sidewalk with the area between the building and property line.

HAZARDOUS AREA/ROOM: An area in a structure of building used for the process or storage that involves highly combustible, flammable, or explosive products or other material which may present a potential danger to life, health, property through fire, explosion, etc.

HISTORIC STRUCTURE: A building deemed to have historical, architectural, or cultural significance by regional or national jurisdiction.

**HYDRAULICALLY DESIGNED SYSTEM:** A calculated sprinkler system in which pipe sizes are selected on a pressure loss basis to provide a prescribed water density, in gallons per minute per square foot (min), or a prescribed minimum discharge pressure or flow per sprinkler, distributed with a reasonable degree of uniformity over a specified area.

**NICET:** National Institute for Certification in Engineering Technologies

**NPS:** National Park Service

**PIPE SCHEDULE SYSTEM:** A sprinkler system in which the pipe sizing is selected from a schedule that is determined by the occupancy classification and in which a given number of sprinklers are allowed to be supplied from specific sizes of pipe.

**RESIDUAL PRESSURE:** The pressure available from the source under flow conditions.

**SPRINKLER SYSTEM:** For fire protection purposes, an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The installation includes one or more automatic water supplies. The portion of the sprinkler system aboveground is a network of specially sized or hydraulically designed piping installed in a building, structure, or area, generally overhead, and to which sprinklers are attached in a systematic pattern. The valve controlling each system riser is located in the system riser or its supply piping. Each sprinkler system riser includes a device for actuating an alarm when the system is in operation. The system is usually activated by heat from a fire and discharges water over the fire area.

**STATIC PRESSURE:** The pressure available from the source when no water is flowing to the system.

**SUPERVISORY SIGNAL:** Indicates abnormal status or need for action regarding fire suppression or other protective system, such as a control valve supervisory/tamper switch.

**TROUBLE SIGNAL:** Indicates that a fault, such as an open circuit or ground, has occurred in indicating appliance circuit, initiating device circuit, or internal to FACP.

**WATER-BASED FIRE SUPPRESSION SYSTEM (FIRE SPRINKLER):** A system of overhead and underground piping to protect the interior or exterior of a building or structure from fire where the primary extinguishing agent is water.

**WATERFLOW ALARM DEVICE:** A mechanical device mounted on the sprinkler pipe that has a paddle internal to the sprinkler pipe to monitor the water for flow. This device is typically monitored by the building fire alarm system.

**WET PIPE SPRINKLER SYSTEM:** A sprinkler system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by heat from a fire.

## 1.8 SYSTEM DESCRIPTION

Provide automatic wet pipe fire sprinkler system in [all areas of the building/areas indicated on the drawings](#), and shall provide for complete fire protection coverage in accordance with required and annex provisions of NFPA 13 for uniform distribution of water. The wet pipe sprinkler system shall be hydraulically designed to provide densities as described in this specification. Activation of waterflow switches shall annunciate an alarm condition at the sprinkler monitoring panel or fire alarm control panel. Valve tamper and circuit trouble conditions shall be annunciated at the sprinkler monitoring panel or fire alarm control panel as supervisory and trouble conditions, respectively. Sprinkler protection shall be provided based on the hazard classifications in this specification and NFPA 13.

### [B. Private Service Main:](#)

[Contractor shall design and install a private fire service main and connect it to the existing water distribution system. The fire service main shall be designed and installed in accordance with applicable sections of this specification and the minimum requirements of NFPA 13 and 24.](#)

### [B. Private Water Distribution System for Fire Suppression:](#)

[Contractor shall design and install a private water distribution system consisting of a water storage tank, private fire service main, fire hydrants, fire pump, and other applicable appurtenances. The Contractor shall tie the sprinkler system to the new water distribution system. The water distribution system and fire service main shall be designed and installed in accordance with applicable sections of this specification and the minimum requirements of NFPA 13, 20, 22, and 24.](#)

## 1.9 SYSTEM COMPONENTS COMPLIANCE

A. Performance requirements for the fire sprinkler will be determined by a review of construction submittals and by field inspection. Compliance review shall be performed by the AHJ, or his/her designee. Compliance review is to verify that the Design/Build Contractor is providing systems, products, and/or materials that will satisfy the stated criteria. This review shall not relieve the Design/Build Contractor from responsibility for any errors or omissions, nor from responsibility for complying with the requirements of the project contract, this specification, or NFPA 13.

## 1.10 HYDRAULIC SYSTEM DESIGN PARAMETERS

### A. Hazard Classifications

#### [1. Light Hazard:](#)

[Provide sprinklers hydraulically designed to provide a minimum density of 0.10 gallons per minute per square foot over 1500 square feet of floor area, for a minimum of 30 minutes. Water supply calculation will include 100 gpm for inside and outside hose streams.](#)

## 2. Ordinary Hazard (Group 1):

Provide sprinklers hydraulically designed to provide a minimum density of 0.15 gallons per minute per square foot over the hydraulically most remote 1500 square feet of floor area, for a minimum of 60 minutes where the sprinkler system is remotely electronically supervised and monitored off site (90 minutes is not remotely monitored). Water supply calculation will include 250 gpm for inside and outside hose streams.

## 3. Ordinary Hazard (Group 2):

Provide sprinklers hydraulically designed to provide a minimum density of 0.20 gallons per minute per square foot over the hydraulically most remote 1500 square feet of floor area, for a minimum of 60 minutes where the sprinkler system is remotely electronically supervised and monitored off site (90 minutes if, not remotely monitored). Water supply calculation will include 250 gpm for inside and outside hose streams.

# B. Hydraulic Design Requirements:

## 1. Sprinkler Discharge Area:

The discharge area for each system shall be the hydraulically most remote area as defined in NFPA 13 and as stated for the occupancies referenced above.

## 2. Friction Losses:

Losses in pipe shall be calculated in accordance with the Hazen-Williams formula with "C" values in accordance with NFPA 13.

## 3. Water Supply:

Contractor shall be responsible for performing waterflow test to determine the performance of the water distribution system. Flow tests shall be performed on the two fire hydrants closest to the facility in which the wet pipe sprinkler is to be installed. A minimum 10 pounds per square inch safety margin over the required pressure shall be incorporated into all hydraulic calculations. If the systems requirements are not met, it is the responsibility of the contractor to identify alternative options with costs and discuss with the AHJ.

The following information is required:

Hydrant 1

Location: \_\_\_\_\_

Static Pressure \_\_\_\_ psi

Residual Pressure \_\_\_\_ psi

Hydrant 2 (Flow Hydrant):

Location: \_\_\_\_\_

Gallons per Minute (Flow) \_\_\_\_ gpm

@ \_\_\_\_ psi

C. Location and spacing of sprinklers in relation to the ceiling, light fixtures, ventilation equipment, storage, ceiling fans, and soffits, shall not exceed that permitted by NFPA 13 and the listing of each sprinkler. The spacing of sprinklers on the branch lines for open areas shall be uniform.

D. Drain pipes shall be 2 inch and valves shall be installed on the system to allow drainage. The system shall drain to the maximum extent possible through the main drain valve. Discharge from the drain pipe shall be to the building exterior, directed away from the building and stair. The discharge from the drain pipe shall be piped to within 8 inches of grade. Splash blocks under the drain outlet shall be provided to prevent soil erosion. Discharge to sump pumps, floor drains, sinks and waste lines, etc. is not permitted.

### **1.11 PIPE SCHEDULE SYSTEM DESIGN PARAMETERS**

A. Pipe schedule method shall not be permitted.

B. The pipe schedule method may be permitted for additions or modifications to existing extra hazard pipe schedule systems at the discretion of the AHJ.

### **1.12 SUBMITTALS**

A. The AHJ shall review and "accept/reject" or take other appropriate action on the Contractor's submittals including shop drawings, samples, documentation and as-built drawings. This review is to verify conformance to project specifications and design concepts expressed in the contract documents. The AHJ is allotted 20 working days to review and approve/reject each submittal.

B. Shop Drawings:

1. Contractor shall prepare and submit a minimum of four (2) complete sets of detailed shop drawings indicating the proposed layout of equipment, mains, risers, hangers, pipes and sprinklers.

2. Drawings shall be drawn to scale, not less than 1/8-inch equals 1-foot, on sheets not smaller than 24 inches x 36 inches, in accordance with all requirements for "Working Drawings (Plans)" as specified in NFPA 13 including cross sections.

3. Drawings shall comply with chapter 22 (Plans and Calculations) of NFPA 13 and contain all applicable information found in section 22.1.3 of NFPA 13.

4. Drawings shall be stamped/sealed by a fire protection engineer registered in the State of [ \_\_\_\_\_ ], or a certified NICET Level III Automatic Sprinkler Layout Technician.

5. Drawings shall show hydraulic reference points with hydraulically most remote areas clearly shown, and proof by example that area shown is in fact the hydraulically most remote.

C. Design Data:

1. Contractor shall submit for approval to the COR calculations, and other information for the wet pipe sprinkler system, stamped/sealed and signed by professional fire protection engineer registered in the State of [ \_\_\_\_\_ ] prior to beginning any work.

#### D. Product Data

1. Submit four (2) complete sets of descriptive data (manufacturer's cut sheets) marked-up to show the specific model, type and size of each item proposed. Full descriptive data shall be submitted for all components essential to proper installation, including, but not limited to: sprinklers, pipe, fittings, gate valves, butterfly valves, check valves, backflow devices, hangers, flow switches, tamper switches, materials and other associated equipment.
2. Prepare and submit a minimum of four (2) complete sets of hydraulic calculations.

#### E. Project Record Documents

1. Contractor shall prepare, on a daily basis, red-lined shop drawings to record as-built conditions. Submit completed red-line drawings to the Contracting Officer and the AHJ at project completion.
2. Prepare and submit four (2) sets of record shop drawings, product data, and hydraulic calculations reflecting final as-built conditions at completion of project, but before final acceptance of the work. These documents shall be prepared in accordance with the requirements for the initial submittal. Freehand sketches or mark-up documents are not acceptable. Record drawings shall be on reproducible sepia.

#### F. Operations and Maintenance Data:

1. Furnish four (4) sets of instruction manuals containing complete operation and maintenance instructions for the specific make and model of check valves, control valves, waterflow switches, valve supervisory switches, control panels, and other components supplied. Include maintenance data relative to components of the system, servicing requirements, inspection data, replacement part numbers and availability, and location and numbers of the service depot.

#### G. Contractor's Material and Test Certificates

1. Upon completion of required testing the contractor shall submit completed and signed material and test certificates for aboveground, underground piping and backflow prevention devices certifying system meets or exceeds the specified requirements. The Contractor shall use the following National Park Service forms:
  - Aboveground Piping Acceptance Test Form (Form AS-5)
  - Underground Piping Acceptance Test Form (Form AS-4)
  - Backflow Prevention Assembly Test Form (Form BF-1)
  - Fire Pump Acceptance Form (Form FP)

- Fire Hydrant Acceptance & Flow Test Form (Form FH-1)
- Fire Alarm Record of Completion and Acceptance Form (FA-2)

#### H. Final Acceptance Test

1. Contractor shall propose procedures for final acceptance test, no later than [14] days prior to the proposed start of the tests. Contractor shall submit final acceptance test procedures at the same time proposed final acceptance test date and time are submitted. Notification shall include a copy of the Contractor's Material and Test Certificates. AHJ or their designee shall be present for all acceptance / commissioning tests.

### 1.13 DELIVERY, STORAGE AND HANDLING OF MATERIALS

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. It is the responsibility of the contractor to maintain all parts in a safe, secure place until installation.
- C. The storage location must meet the approval of the CO.
- D. Provide temporary protective coating on cast iron and steel valves during the storage period.
- E. All stored pipe shall be support off the ground at all times.

### 1.14 GUARANTEE

- A. The Contractor, in addition to other warranties or guarantees required by the contract documents, shall guarantee workmanship on all piping, devices, and related materials for a period of one year from the date of the Contracting Officer's final acceptance of the work. All defects shall be promptly corrected at no cost to the Owner.
- B. The Contractor is responsible for providing a system that has been coordinated with the contract documents and approved by the Contracting Officer.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The Contractor shall provide all labor and materials for a complete NFPA 13 compliant wet pipe fire sprinkler. All equipment supplied under this specification shall be new and, where required by the NFPA or this specification, shall be UL-listed or FM-approved for fire protection systems and installed and used as intended by the listing.



B. The Contractor shall design and install a fire protection system and shall connect the system to the [existing/new private/public](#) water main in such a way that the shutdown of the facility potable water line will not shutdown the fire sprinkler water supply. Connection to the existing water service shall be made with a dielectric flange union. Provide a double check valve backflow prevention assembly with listed valves.

C. Sprinkler System:

1. Contractor shall provide a hydraulically designed wet pipe automatic sprinkler system. The sprinkler system shall provide complete sprinkler coverage of the building.

2. Contractor shall verify the performance limits of the existing water distribution system by performing a water flow test, using the two hydrants that are closest to the facility to be protected. The water flow test shall be performed in accordance with NFPA 291. The results of the water flow test shall be provided to the AHJ for review prior to the completion of sprinkler system design.

3. Upright, pendent, and sidewall sprinkler shall be installed as approved by the AHJ. Recessed pendent sprinklers shall be installed in all finished ceiling areas unless otherwise approved by the COR. Sidewall and dry pendent and dry sidewall sprinklers may be used where authorized and approved by the AHJ.

4. The sprinkler riser main drain and inspector's test valve discharge shall be routed to the exterior of the building. The inspector's test valve shall be terminated with a smooth-bore, corrosion-resistant outlet. The inspector's test discharge shall simulate a flow equivalent to one sprinkler. Contractor shall provide a splash block or rip-rap below the discharge outlet of all drain outlets to prevent erosion.

5. Sprinkler system design criteria shall be based on section 1.11 of this specification and the occupancy hazard classification section of NFPA 13.

6. Where more than 20 heads are necessary a fire department connection is required. The AHJ shall be consulted about the location of the FDC.

7. Where required due to inclement weather, portions of the sprinkler system that extend into unheated areas of the facility, attic spaces, porches and other exterior spaces, an antifreeze system, using propylene glycol, may be installed as approved by the AHJ. The antifreeze system shall be designed and installed in accordance with NFPA 13, and shall have an approved reduced pressure backflow prevention device installed between the wet and antifreeze portions of the system.

8. Contractor shall provide and install a spare sprinkler box, near the riser, that contains spare sprinkler heads of all head types used in the system; the number of which shall be in accordance with NFPA, and a sprinkler wrench.

9. Contractor shall install a sprinkler monitoring panel/fire detection and notification system, or connect sprinkler water flow and tamper switches to the existing fire detection and notification panel. Water flow switch activation shall trigger a fire alarm condition at the fire alarm control panel. Tamper switch activation shall trigger a supervisory alarm condition at the fire alarm control panel.

10. Sprinkler system design shall include materials, accessories, and equipment inside and outside building, to include all fittings, valves, sprinklers, specialty items, and appurtenances required for a complete and operable water-based fire suppression system to provide system complete and ready to use.

11. Paint all interior exposed ferrous metal piping and ferrous metal pipe supports with installed in tenant spaces with one coat primer and two coats of corrosion resistant exterior enamel. Finish paint color shall match surrounding surfaces. Paint color shall be approved by the Contracting Officer.

12. Contractor shall provide NFPA 13 compliant labels and signs for all system control valves and drains.

13. Contractor shall attach an NFPA 13 compliant hydraulic design plate to the system riser.

## **2.2 UNDERGROUND PIPING**

A. Underground pipe shall be UL-listed or FM-approved for fire protection systems.

B. The pressure class of the pipe, joints, fittings, valves and hydrants shall not be less than the maximum working pressure of the system under non-emergency (no-flow) conditions. In no case shall the pressure class be less than 175 pounds per square inch.

C. Ductile iron pipe shall be joined by approved means.

D. Fittings shall be cast iron or ductile iron listed and/or approved for fire main underground installations.

## **2.3 ABOVEGROUND PIPING SYSTEMS**

A. Pipe shall be per NFPA 13. Schedule 10 pipe or smaller will not be approved. All steel pipe must be Schedule 40.

B. Fittings shall be cast iron, or malleable iron, or steel conforming to NFPA 13 requirements.

## 2.4 SPRINKLERS

- A. Sprinklers in areas with finished ceilings shall be recessed, ordinary temperature, *chrome plated, concealed pendent*, quick-response type *with coverplates factory-painted to match existing ceilings*.
- B. Sprinklers in areas without finished ceilings shall be upright or pendent, polished brass, unless otherwise specified. Sprinklers shall be quick-response type, ordinary temperature rated, except where a higher temperature rating is necessary for individual sprinkler locations, as approved by the AHJ.
- C. Sprinklers shall be U.L. listed for the intended application.
- D. Areas of higher temperature, (eg: machine rooms, generator rooms, elevator machine rooms etc.) shall have appropriate temperature sprinkler for the intended application.
- E. Sprinklers subject to mechanical damage shall be properly protected with listed guards, in accordance with the requirements of NFPA 13.
- F. Corrosion resistant sprinklers shall be installed in locations where chemicals, moisture, or other corrosive vapors sufficient to cause corrosion of such devices exists.
- G. Sprinklers shall not be painted in the field. The Contractor shall ensure proper protection is provided to prevent the painting of sprinklers by other trades and contractors. Any sprinklers that have been painted shall be replaced by the Contractor with new listed sprinklers of the same characteristics, including orifice size, thermal response, and water distribution.
- H. Install pendent sprinklers in suspended ceilings a minimum of 6 inches from ceiling grid. Install recessed pendent sprinklers such that the distance from the sprinkler deflector to the underside of the ceiling does not exceed the manufacturer's listed range and is of uniform depth throughout the finished area.
- I. Where dry pendent sprinklers are allowed by NFPA 13, and approved by the AHJ, dry pendent sprinklers shall be of the required length to permit the sprinkler to be threaded directly into a branch line tee, and to permit entirely concealing the dry sprinkler barrel. Hangers shall be provided on arm-overs exceeding 12 inches in length.

## 2.5 SPRINKLER MONITORING

- A. Vane type water flow indicators shall be installed in each system main riser where the riser connects to the system water supply.
- B. Activation of any water flow switch shall cause an audible alarm on premises within 5 minutes of the flow of water across said device and shall continue until the flow of water is terminated.
- C. Switches shall be set to signal any flow of water that equals or exceeds the discharge from any one sprinkler within 30-40 seconds. Waterflow switch mechanisms shall incorporate an instantly recycling pneumatic adjustable retard element, adjustable up to two minutes.

D. Where sprinkler monitoring panels or fire alarm control panels monitor sprinkler system components the panel shall be capable of transmitting a signal to an approved central/remote station within 90 seconds of water flow or supervisory switch activation.

E. Valve Supervisory Switches: Provide sprinkler control valves with approved circuit supervisory (tamper) switches. The supervisory signal shall be obtained during the first two revolutions of the hand wheel or operating crank. The switch shall not interfere with the operation of the valve nor obstruct the view of its indicator. Devices shall be compatible with the fire alarm control panel or sprinkler monitoring panel, where existing or proposed, and the requirements of NFPA 72. All switches shall be suitable for installation as end-of-line devices.

F. Pressure Gauges: Pressure gauges shall be the a metal corrosion-resistant case, liquid filled, flat glass window, 3½-inch diameter with background dial with black markings, and a 0-300 pounds per square inch gauge range. Gauge accuracy shall be 3-2-3 percent of full range. A shut-off valve shall be provided with each gauge connection.

G. Check Valve: Provide a listed/approved swing-type check valve in the sprinkler system riser assembly prior to any branch lines. A backflow prevention device listed for water-based fire protection systems shall be allowed, as approved by the AHJ.

H. Fire Department Connection: The fire department connection (FDC) shall be a projecting, single port or Siamese (Y-type) as approved by the AHJ, with cast brass body, and shall be provided with sign lettered "Automatic Sprinkler." The FDC inlet(s) shall have individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2½-inch diameter threads compatible with the local fire department. The FDC shall be located on the exterior wall on the street (entrance) side of the facility, as approved by the AHJ. The FDC installation shall include a 4-inch swing-type check valve, or as determined by hydraulic calculation and approved by the AHJ. A ball drip assembly shall be provided with the drain piped outdoors.

I. Where approved by the AHJ steel pipe can be used between the check valve and the outside hose coupling for the fire department connection assembly. The steel pipe must be hot dipped galvanized inside and out, and externally coated and wrapped.

J. Backflow Preventer: Provide double detector check valve assembly backflow preventer with gate valves. The entire assembly (check valves and gate valves) shall be listed for fire protection systems. Each check valve shall have a drain. Backflow prevention assemblies shall have current "Certificate of Approval" from the Foundation for Cross-Connection Control and Hydraulic Research. Means shall be provided downstream of all backflow prevention valves for flow tests at system demand.

## 2.6 GAUGES

A. A listed pressure gauge shall be installed immediately below the control valve of each system.

B. Pressure Gauges: Pressure gauges shall be the a metal corrosion-resistant case, liquid filled, flat glass window, 3½-inch diameter with background dial with black markings,

and a 0-300 pounds per square inch gauge range. Gauge accuracy shall be 3-2-3 percent of full range. A shut-off valve shall be provided with each gauge connection.

C. A pressure gauge with a connection not smaller than one-quarter ( $\frac{1}{4}$ ) in. shall be installed at the system main drain, at each main drain associated with a floor control valve, and on the inlet and outlet side of each pressure reducing valve.

D. Each gauge connection shall be equipped with a shutoff valve and provisions for draining.

E. The required pressure gauges shall be listed and shall have a maximum limit not less than twice the normal system working pressure at the point where installed.

F. Gauges shall be installed to permit removal and shall be located where they will not be subject to freezing.

## **2.7 VALVES**

A. All valve assemblies shall meet or exceed the requirements as outlined by NFPA 13.

B. Provide valves as required by NFPA 13 and of types approved for fire service. Sprinkler control valves shall open by counterclockwise rotation and be OS&Y or butterfly type. Valves 2 inches and smaller shall be bronze. Valves 2½ inches and larger shall be iron bodies, bronze mounted.

C. Gate Valves

1. Up to and including 2 inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc.

2. Over 2 inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, resilient-seated.

D. Globe Valves

1. Up to and including 2 inches: Bronze body, bronze trim, rising stem and handwheel, inside screw.

2. Over 2 inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug type disc, renewable seat and disc.

E. Ball Valves

1. Up to and including 2 inches: Bronze one-piece body, stainless steel ball, Teflon seats and stuffing box ring, lever handle and balancing stops. Over 2 inches: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged.

#### F. Butterfly Valves

1. Bronze body, stainless steel disc, and resilient replaceable seat, threaded ends, extended neck, handwheel and gear drive and integral indicating device, and built in tamper proof switch for signal transmission to the fire alarm system.
2. Cast or ductile iron body, chrome plated ductile iron disc, resilient replaceable EPDM seat, extended neck, handwheel and gear drive and integral indicating device and built-in tamper proof switch for signal transmission to the fire alarm system.

#### G. Underground Valves

1. All valves controlling connections to water supplies and to supply pipes to sprinklers shall be listed indicating valves. Such valves shall not close in less than 5 seconds when operated at maximum possible speed from fully open position.
2. A non-indicating valve such as an underground gate valve with approved roadway box, complete with T-wrench shall be permitted.
3. Post Indicating Valve (PIV) shall be permitted.

### 2.8 INSPECTOR'S TEST CONNECTION

A. Provide test connection(s) approximately 6 feet above the floor. Provide test connection piping to a location where the discharge will be readily visible or provide a test connection with sight glass assembly. The test piping shall discharge to exterior grade and onto a splash block so as to prevent damage to the structure or landscape.

B. System, main drain or sectional drains, connections piping shall be routed to a location where the discharge will be readily visible. The test piping shall discharge to exterior grade and onto a splash block so as to prevent damage to the structure or landscape.

### 2.9 PIPE HANGERS AND SUPPORT

A. Pipe hangers, braces and supports shall be in accordance with NFPA 13.

B. Hangers for support of piping and equipment shall be types approved for fire protection service. Supports including all threaded rods shall not interfere with access to operating areas, obstruct electrical junction boxes, or impact the reliability and operations of facility equipment and systems. In areas subject to earthquakes additional seismic bracing will be required on all hangers and installed according to NFPA 13 and the IBC.

### 2.10 PIPE SLEEVES

A. Systems requiring galvanized pipe: For sleeves in masonry and concrete walls, floors and roofs provide, Schedule 40 or standard weight, hot-dip galvanized steel pipe sleeves.

B. Systems requiring galvanized pipe: For sleeves in partitions, and other than masonry

and concrete walls, floors and roofs provide hot-dip galvanized steel sheet having a nominal weight of not less than 0.90 pounds per square foot.

## **2.11 PIPE ESCUTCHEON PLATES**

A. Provide approved one piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed areas. Provide **chromium-painted finish, or white painted finish escutcheon plates, as approved by the AHJ**, in finished areas. Securely anchor plates in place with set screws or other approved means.

## **2.12 RISER ROOM**

A. Room which supports the sprinkler riser shall not be subject to temperatures below 40 degrees Fahrenheit. Where these conditions may exist, provisions shall be made to comply with NFPA 13.

# **PART 3 - EXECUTION**

## **3.1 PREPARATION**

- A. Coordinate work of this section with the COR or his/her designee.
- B. The Contractor shall take any necessary measures to prevent damage to the facilities and equipment, and shall take any necessary measures to prevent accidental water discharge at all times. All collateral damage resulting from the work and testing under this section, whether intentional or not, shall be repaired by the Contractor at no cost to the government.
- C. At any time "Hotwork" is being performed by the contractor a valid NPS Hot Work permit shall be on site.
- D. At anytime an existing fire protection system is disabled by the contractor the contractor is responsible for notifying COR and the building occupants, and for establishing a fire watch until the fire protection system is restored to normal conditions. Under no circumstances shall a fire protection system be let out of service overnight.
- E. The Contractor is responsible for the safe work place environment for their employees and contractors. The contractor shall comply with the OSHA standards.
- F. Ream pipe and tube ends to remove all burrs.
- G. All excess oil, dirt, pipe joint compound, rust, and mill scale shall be removed from piping and equipment. All dirt, debris and excess cutting oil shall be removed from the interior of all piping and equipment before it is erected.
- H. Cap off open newly installed pipe at the end of each work day to prevent insects, rodents or other potential obstructions from entering the pipe.
- I. Storage of equipment, tools, and materials is the sole responsibility of the Contractor. Arrangements shall be made with the COR prior to work.

J. Storage of material shall be stacked in an orderly fashion and meet the satisfaction of the COR. The storage shall be safeguarded to prevent accidents from occurring around the stored material.

K. Piping shall be inspected by, tested in the presence of, and approved by the AHJ or his designee before covering, or concealing. Provide fittings for changes in direction of piping and for all connections. Make changes in pipe sizes through tapered reducing pipe fittings; the use of bushings will not be permitted. This should be Part 3 Execution.

L. Welding shall be performed in the shop; field welding will not be permitted.

M. Where possible and as approved by this the COR, the Contractor shall conceal piping, fittings, fixtures, hangers and supports in areas with suspended ceilings and finished areas.

N. Piping joined by threaded methods shall be Schedule 40 for sizes less than 8-inch pipe.

O. Pipe shall be joined by screwed, rolled-groove, welded or flanged methods.

### **3.2 EXTRA MATERIALS**

A. Provide spare sprinklers under provisions of NFPA 13. The quantity of each type of extra sprinkler shall be as specified in NFPA 13.

B. Provide suitable wrenches for each type of sprinkler.

C. Provide metal cabinets for storage of spare sprinklers and sprinkler wrenches. Cabinets shall be of sufficient size to permit spare sprinklers to fit upright and be reasonably secured within the cabinets.

D. Cabinets shall be wall mounted adjacent to the sprinkler system riser, unless otherwise approved.

E. Provide two (2) of each type of key and/or special tool required for system use and maintenance, include access tools for waterflow and tamper switches.

### **3.3 PATCHING AND PAINTING (FINISH WORK)**

A. Patching:

1. Replacement or repair materials shall match those of the existing adjacent surfaces.

2. Finished surfaces shall be repaired to match existing finished surfaces.

3. All surfaces, walls, floors and ceilings shall be repaired to maintain their integrity and fire resistance.

4. Replace fireproofing material removed from structural steel with new fireproofing material of equal or better fire rating. New fireproofing material shall be acceptable to the COR.



5. New replacement ceiling tiles shall be supplied by the Contractor and shall match the existing tiles.

B. Painting:

1. All new paint colors and textures shall match those of the existing adjacent areas.
2. The Contractor shall repaint the entire existing ceiling and/or wall surface that has been altered or damaged or where soffits are added due to installation of new work.
3. Spot painting will be acceptable only if the painting matches the existing paint, to the satisfaction of the Contracting Officer or his/her designee. If the spot painting does not match, the Contractor shall repaint the entire contiguous surface.
4. Color and texture of finish coats shall match existing.
5. Color of priming coat shall be lighter than body coat.
6. Color of body coat shall be lighter than finish coat.
7. Primer and body coats shall be colored to mask surface imperfections and so they do not show through the finish coat.

C. Paint Preparation:

1. The Contractor shall thoroughly mix all painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
2. Finish paint shall not be used as primer. Primers must be matched to substrate being painted:
3. Dry wall - polyvinyl acetate primer latex.
4. Metal - primer required by manufacturer for proper adhesion.
5. Masonry - proper masonry sealer/primers to insure proper adhesion to substrate.

D. The Contractor shall not thin materials, unless necessary for proper application and when finish paint is used for body and prime coats. Materials and the quantities used for thinning shall be in accordance with the manufacturer's printed instructions.

E. The Contractor shall remove all paint skins, then strain paint through commercial paint strainer to remove all lumps and other particles.

F. Two-component and two-part paint and those requiring additives shall be mixed in such a manner as to be uniformly blended in accordance with the manufacturer's printed instructions.

G. The Contractor shall use color pigment recommended by the paint manufacturer for tinting required to produce exact shades specified.

### **3.4 PATCHING AND PAINTING (CLEAN-UP)**

A. Upon completion, the Contractor shall clean paint from all hardware, glass and other surfaces and items not required to be painted.

B. Before final inspection, any work that has become damaged or discolored shall be touched up or refinished by the Contractor in a manner to produce solid even color and finish texture, free from defects.

C. The Contractor shall be responsible for replacing and/or repairing any and all areas damaged during the execution of this work.

D. The areas of cutting, coring, demolition, debris removal, and painting; the inside and outside of the building shall be left in a safe and clean condition suitable for the installation of new work.

E. A steel sleeve of adequate size to allow an approximate 1-in. (25-mm) clearance between the sleeve and the pipe or raceway shall be provided for each pipe or raceway. The space between the sleeve and penetrating item (annular space) shall be filled as required to meet the fire rating. Joint reinforcement shall be provided in the horizontal mortar joints immediately above and below sleeves in concrete masonry walls, and all hollow spaces of concrete masonry walls immediately adjacent to the sleeve shall be filled with concrete, mortar, or grout.

### **3.5 INSTALLATION**

A. All work shall be installed in a professional manner (parallel/perpendicular to walls and columns) in accordance with NFPA and NPS standards and other applicable standards referenced by this document. All piping in areas with finished ceilings shall be concealed, unless otherwise approved by the COR.

B. Install all equipment in accordance with manufacturer's instructions.

C. Use proper lubricant on ends of piping or gaskets where required by pipe fitting or coupling manufacturer. The manufacturer's recommended lubricant shall be used.

D. Where required by manufacturer, properly torque bolts to manufacturer's specifications using a torque wrench.

E. Prevent electrolyses by insulating connection between pipe, fittings, hangers or dissimilar metal against direct contact. Use dielectric insulating flanges and units.

F. Support all sprinkler piping, risers, etc., as specified in NFPA 13 and 24. Provide riser clamps above floor at each floor penetration.

G. Provide minimum 1¼-inch diameter, 4-inch long nipples and caps at ends of all cross mains for flushing connections.

H. Sprinkler installation shall be coordinated with the installed mechanical and electrical work and the ceiling grid/layout. Where sprinklers are to be installed on modular ceiling panels, sprinklers shall be located as close to the center of the ceiling panel in both directions as possible. The Contractor shall furnish additional sprinklers, which may be required for coordinated ceiling pattern without additional cost to the NPS, even though number of sprinklers may exceed minimum code requirements.

I. The Contractor shall install the piping and equipment in accordance with approved shop drawings.

J. Main and Auxiliary Drains:

1. Each system shall be furnished with a main drain, which is capable of draining the majority of the system to outside grade. Drainage to floor or sink is not permitted.

2. Auxiliary drains shall be provided to drain any sections of piping that trap water or are not capable of being drained by the main drain in accordance with NFPA 13. Auxiliary drains shall discharge as required by NFPA 13 and the AHJ.

3. All drains terminating outside shall be piped to within 8 inches of finished grade. Concrete splash guards shall be provided at grade level beneath all outside drains. Drainage shall not create damage to the facility or surrounding landscape.

K. The Contractor shall install seismic bracing in accordance with NFPA 13.

L. The Contractor shall install proper UL-listed firestopping materials as required for any penetrations through fire rated construction.

M. Tapping or drilling of load-bearing structural members is not permitted. Attachments may be made to steel or concrete structures with approved clamps and hangers designed in accordance with NFPA 13 and local standards.

N. Provide pipe sleeves where piping passes through walls, floors, roofs, and partitions. Grout sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide clearance between exterior of piping and interior of sleeve in accordance with NFPA 13. Firmly pack space with noncombustible insulation and caulk at both ends of the sleeve with plastic waterproof cement, which will dry to a firm but pliable mass, or provide a flexible seal. Extend sleeves in floor slabs 3 inches above the finished floor.

O. Install valves with stems upright or horizontal as required. Valve stems shall not be inverted.

P. Provisions shall be made by the Contractor to protect piping, sprinklers and other components of the sprinkler systems from extreme climatic conditions including freezing and high temperature (under 40° F, or over 100° F).

Q. Install exposed piping so as not diminish exit access widths, corridors, or equipment access. Install exposed horizontal piping, including drain piping to provide maximum headroom.

R. All control valves shall have signs identifying their function per NFPA 13 requirements.

S. In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, conceal piping above ceilings, inspect, test piping and obtain approval before it is covered up. Conceal risers and similar vertical runs of piping in finished areas.

T. Caution signs shall be attached to all valves controlling sprinkler. The caution sign shall be worded as follows:

***Caution:***

*This valve controls fire protection equipment.*

*Do not close until after fire has been extinguished.*

*Use auxiliary valves when necessary to shut off supply to auxiliary Equipment*

***Caution:*** Automatic alarm will be sounded if this valve is closed

### 3.6 TESTING

A. Inspection and test procedures shall be submitted to AHJ for approval prior to performance of test.

B. Hydrostatically tests all piping and attached appurtenances, to include the piping between the exterior fire department connection and the check valve in the fire department connection inlet pipe, subjected to working pressure at 200 psi or 50 psi above normal operating pressure where the normal operating pressure is greater than 150 psi. The pressure shall be maintained for a period of two (2) continuous hours, and shall maintain that pressure without loss, in accordance with NFPA 13. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

C. Backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams. Provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, playpipe nozzles, calibrated pressure gauges, and pitot tube gauge. Provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, record the pressure readings and pressure drop (friction) across the assembly. Provide a metal placard on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. Compare and report the pressure drop to the manufacturer's data.

D. Testing each alarm initiating device, including waterflow switch, valve supervisory switch, and electrically-operated switch for proper operation. Test water motor alarm or electric bell. Inspect and test the connecting circuit to the building fire alarm system.

E. Main drain flow test shall consist of flushing of the underground piping, make a main drain test to verify the adequacy of the water supply. Record static and residual pressures. In addition, conduct a main drain test each time after a main control valve is shut and opened.

F. Final acceptance testing shall begin only after the preliminary test report has been approved by the AHJ. The Contractor shall conduct the final acceptance test and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. Each system shall be completely drained after each trip test. The system air supply system shall be tested to verify that system pressure is restored in the specified time. In addition, the Contractor shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

G. The Contractor shall make provisions for the proper disposal of water used for flushing or testing. Diversion of flush and test water onto the ground or into drains or waterways is not approved.

H. Leaks in piping shall be immediately corrected. On threaded piping, tighten joints. If necessary, dismantle and replace section. Caulking, peening, or stop-leak compounds will not be permitted.

I. All operating parts, including electrical equipment, shall be fully tested to ensure their proper operation. All control valves shall be fully closed and opened under full system pressure.

J. All sprinkler alarm and supervisory devices shall be fully tested by the Contractor to ensure their proper operation and that they report appropriate signals to the fire alarm or sprinkler monitoring panel.

K. All gaps left by holes and or penetrations created for the installation of fire sprinkler piping, appurtenances, or wiring shall be patched or backfilled with an approved fire stop material or construction.

L. The Contractor shall hydraulically and mechanically pre-test all installed components in accordance with NFPA 13 acceptance test protocols to ensure proper installation and operations prior to scheduling the AHJ system acceptance test.

M. All acceptance testing performed by the Contractor shall be conducted in the presence of the AHJ or his designated representative, and other representatives at the option of the NPS. All persons concerned shall be notified two (2) weeks in advance of the tests in order to arrange attendance at the tests.

N. The Contractor shall perform supplemental tests and shall render additional services in connection with the sprinkler system, as directed. The cost, if any, will be negotiated prior to the test. The effect of additional tests, if any, on the delivery schedule shall be determined prior to undertaking the test.

**---END OF SECTION---**